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**Cornell-Dubilier Electronics Site**  
**Operable Unit 4 – Bound Brook**  
**South Plainfield Borough, Middlesex County, New Jersey**

**Stakeholder Information Package**

**EPA Region 2**

**March 2014**

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*The following summary of the Remedial Investigation and Feasibility Study (RI/FS) for Operable Unit 4 of the Cornell-Dubilier Electronics, Inc., Superfund site is provided to stakeholders for the site, to aid in preparing submissions to the National Remedy Review Board. Since the RI/FS reports are still being developed, the information in this summary is current as of March 1, 2014. As work on the RI/FS progresses, the information may be updated and modified. This document should not be relied on as a summary of the final RI/FS.*

## **SITE SUMMARY**

Cornell-Dubilier Electronics, Inc., operated a facility at 333 Hamilton Boulevard, South Plainfield, New Jersey (former CDE facility), from 1936 to 1962, manufacturing electronic parts and components including capacitors. During site operations, the company released/buried material contaminated with polychlorinated biphenyls (PCBs) and chlorinated volatile organic compounds (VOCs), primarily trichloroethylene (TCE), contaminating site soils. EPA has detected PCBs and VOCs in the groundwater and soil at the former CDE facility and PCBs on nearby residential, commercial and municipal properties. EPA also detected PCBs and VOCs in the surface water and sediments of Bound Brook and downstream floodplain soils. The focus of this Information Package is Operable Unit 4 (OU4), which addresses site contamination in the Bound Brook corridor (the stream channel, adjacent floodplain soils, and tributaries). Figures 1 and 2 show the regional location of Bound Brook and of the OU4 Study Area.

Bound Brook, located in Middlesex County, New Jersey, is a secondary tributary of the Raritan River that flows into Raritan Bay (south of Staten Island, New York) and into the Greater New York/New Jersey Harbor (Figure 1). The headwaters of Bound Brook originate in areas of residential and commercial/industrial development in Edison Township. Bound Brook flows westerly through the Borough of South Plainfield into Piscataway Township, where the water is dammed to form New Market Pond. The brook then flows through Middlesex Borough to the confluence with Green Brook. The Study Area encompasses an 8.3-mile long portion of Bound Brook, plus an additional 1.6-mile long portion of Green Brook, portions of Cedar Brook, Spring Lake, and two other unnamed tributaries to Bound Brook.

A River Mile (RM) system was developed for the Study Area, with RM0 placed at the confluence of Bound Brook and Green Brook (Figure 2). This river mile system was used to position 2010-2013 RI sampling locations, reference historical sampling locations, and describe the location of prominent site features. As determined by EPA, the upstream extent of the investigation area is at RM8.3 at the Talmadge Road Bridge on Bound Brook in Edison, New Jersey, and the downstream extent is at RM-1.6 at the Shepherd Avenue Bridge on Green Brook in Bridgewater. The northern extent of the Study Area on Cedar Brook is Cedar Brook Avenue in South Plainfield. The Study Area includes:

- Surface water and sediments in the channel from RM-1.6 to RM8.3, plus the three major tributaries to Bound Brook: the unnamed tributary near New Brunswick Avenue (confluence at RM4.7), the unnamed tributary near Elsie Avenue (confluence at RM5.5), and Cedar Brook. Minor tributaries, ditches, and culverts are part of the OU4 Study Area, but they were not investigated under the RI.
- Floodplain soils from RM-1.6 to RM7.4 located mainly on public lands adjacent to the brook and accessible for sampling. Floodplain soils, tributaries, and wetlands upstream of RM7.4 were investigated as part of the Woodbrook Road Dump Superfund site (Woodbrook site) (which extends between RM7.4 and RM7.8) and addressed by the Woodbrook site ROD, issued in September 2013.

The upland areas surrounding the OU4 Study Area contain a mixture of land uses including residential, commercial, industrial (including railroads), and recreational or undeveloped land.

OU4 has been divided into four remedial action areas as follows:

- Sediment and Floodplain Soils (SS): primarily PCB-contaminated floodplain soils and brook sediments that pose unacceptable risk to human and ecological receptors.
- Capacitor Debris (CD): generally areas proximal to the former CDE facility (both within and outside of the 100-year floodplain) that contain capacitor debris in the surface and subsurface soils.
- Groundwater Discharge to Surface Water (GW): the area where contaminated groundwater from the former CDE facility (containing PCBs and chlorinated volatile organics) is discharging to Bound Brook. The groundwater discharge has the potential to recontaminate sediments and contribute contaminant loads to the water column for decades or potentially centuries, due to back-diffusion of contamination from the bedrock matrix to groundwater, and then discharge of contaminated groundwater to surface water. EPA has already concluded in the context of the groundwater RI/FS that addressing the bedrock groundwater is technically impracticable (TI), and has waived applicable or relevant and appropriate requirements in groundwater for an area of approximately 825 acres. This was addressed in the Record of Decision (ROD) for OU3 of the site.
- Potable Water Line (WL): a municipal water line crosses the former CDE facility property. A potential future leak in this water line could mobilize subsurface contaminants and adversely impact the OU2 and OU4 remedies. Remedial alternatives, including abandonment and relocation of this water line to a new alignment outside the former CDE facility (OU2), were evaluated as part of the OU4 Feasibility Study (FS).

**Brief Site History:** The 26-acre property known as the former CDE facility is located adjacent to Bound Brook between RM6.1 (Lakeview Avenue Bridge) and RM6.6 (twin culverts). The Spicer Manufacturing Company operated on the property from 1912 to 1929, manufacturing

universal joints and drive shafts, clutches, drop forgings, sheet metal stampings, screw products, and coil springs for the automobile industry. Most of Spicer's major structures were erected by 1918. At least until the late 1920s, Bound Brook was dammed just upstream of the Conrail Railroad Bridge to create a condenser impoundment pond. When the Spicer Manufacturing Company ceased operations at the facility, the property consisted of approximately 210,000 square feet of buildings. Although TCE, a documented groundwater contaminant at the former CDE facility, was commercially available during the latter half of Spicer Manufacturing Company's period of operation at the former CDE facility, there is no documentation that TCE was used in Spicer's manufacturing process.

After the departure of the Spicer Manufacturing Company, CDE manufactured electronic components, including PCB-containing capacitors, from 1936 to 1962, documented in multiple catalogs and marketing material from that time period. Much of the PCB-contaminated debris and soil found on site contained Aroclor 1254, suggesting that this was the primary PCB product during much of the company's operations, though Aroclor 1242 was also detected. ("Aroclor" is a PCB trade name that refers to specific chlorinated biphenyl mixtures.) Based on deposition testimony, CDE was using Aroclor 1242 in the early 1960s in power factor capacitors. It has been reported that the company also tested transformer oils for an unknown period of time. PCB and chlorinated organic degreasing solvents were used in the manufacturing process, and the company disposed of PCB-containing materials and other hazardous substances at the facility. It has been reported that the rear of the property was saturated with transformer oils and capacitors were also buried behind the facility. The primary site-related chemicals of concern are PCB compounds and VOCs. The company released PCB-contaminated material and TCE directly onto the soils during its operations. After CDE departed from the facility in 1962, it was operated as a rental property for commercial and light industrial tenants.

EPA has detected PCB Aroclors in the groundwater, soil, in building interiors at the former CDE facility, and at nearby residential, commercial, and municipal properties. EPA also has detected PCB Aroclors in the surface water and sediments of Bound Brook, which is adjacent to the former CDE facility's southeast corner.

EPA divided the CDE Superfund site into four Operable Units (OUs) as shown on Figure 4. OU1 addresses residential, commercial, and municipal properties in the vicinity of the former CDE facility. EPA signed a Record of Decision (ROD) for OU1 in 2003. OU2 addresses contaminated soils and buildings at the former CDE facility. EPA signed a ROD for OU2 in 2004. OU3 addresses contaminated groundwater. EPA issued a ROD for OU3 in September 2012. As such, the following terminology will be used throughout this document:

- The "site" refers to all four OUs which comprise the CDE Superfund site, and the extent of each OU investigation;
- The "former CDE facility" refers to the physical extent of the industrial park operated at 333 Hamilton Boulevard, South Plainfield, New Jersey; and

- “OU4” refers to the geographic extent of the Bound Brook and Green Brook contamination and associated investigation; this area is also referred to as the “OU4 Study Area” or, simply the “Study Area.”

In June and August 1997, EPA collected soil, sediment, surface water, and biota samples (small mammals, crayfish, forage fish, and edible fish) along Bound Brook to support an ecological risk assessment (ERA). In 2008 and 2009, EPA collected additional fish and invertebrate (Asian clam) samples in Bound Brook to reassess ecological risks (Reassessment) and to “fingerprint” the PCB congeners within Bound Brook, between the former CDE facility and New Market Pond. The program was designed for the 2008 sampling locations to be within the vicinity of the 1997 sampling locations. Through both the 2008/2009 Reassessment and the 1997 ERA, EPA concluded that a substantive ecological risk exists to fish and wildlife within Bound Brook and Spring Lake.

EPA conducted the remainder of the OU4 RI field work between 2011 and 2013, which included side scan sonar and bathymetric surveys, hydrodynamic surveys and modeling, surface water and suspended matter sampling, sediment probing and physical properties analyses of sediment, sediment sampling (including radiologically dated sediment cores, surface sediment grab samples, and sediment trap samples), floodplain soil sampling (surface and subsurface), upland soil borings in suspected capacitor debris areas, stream flow surveys, passive porewater sampling for VOCs and PCBs in suspected groundwater discharge areas, and terrestrial and aquatic worm toxicity and bioaccumulation studies using surface sediments and soils collected from Bound Brook and two reference sites, Ambrose Brook and Lake Nelson. A series of historical sampling events were also conducted by EPA and others and are summarized in the RI. EPA expects to receive the final RI/FS deliverables in spring 2014.

**Scope and Role of Operable Unit** - This is the final planned action for the site, addressing PCB-contaminated brook sediments and floodplain soil, capacitor debris, contaminated groundwater discharging to Bound Brook, and the municipal water line beneath the former CDE facility. EPA’s findings indicate the presence of principal threat wastes (PTWs) at OU4, specifically the capacitor debris. A brief description of the disposition of the other OUs that comprise the CDE Site is provided below.

In the late 1990s, EPA and others conducted a series of soil and interior dust investigations at residential, commercial, and municipal properties in the vicinity of the former CDE facility. The results of these investigations revealed the presence of soil and interior dust contaminated with PCB Aroclors. EPA subsequently ordered a number of removal actions in the 1990s, and in 2000, expanded the investigations by collecting soil and interior dust samples from properties further from the former CDE facility. In September 2003, EPA selected an OU1 remedy to address PCB-contaminated soils and interior dust at properties in the vicinity of the former CDE facility, with concurrence from NJDEP. The remedy requires the excavation, off-site

transportation, and disposal of PCB-contaminated soils, and property restoration (EPA, 2003). The OU1 remedy also calls for interior dust cleaning at properties where PCB Aroclors are detected indoors. Using federal and state funds, EPA began remediating the first OU1 properties in 2005; remediation work was substantially completed in 2014. OU1 properties are generally located outside of the OU4 Study Area to the south and southwest of the former CDE facility. As of February 2014, over 115 properties have been sampled or considered for sampling, and remedial actions have been completed at 33 properties.

Environmental conditions at OU2, the former CDE facility property, were first investigated by NJDEP in 1986. Subsequent sampling by NJDEP and EPA detected PCB, VOC, and inorganic contaminants in facility soils, sediments, and surface water. Between 1994 and 1996, EPA conducted sampling at OU2 and detected elevated PCB Aroclor concentrations in the samples. In March 1997, EPA ordered D.S.C. of Newark Enterprises, Inc. (DSC), the CDE facility property owner, to perform a removal action to mitigate contaminated soil and surface water runoff from the facility. The removal action included paving driveways and parking areas in the former CDE facility, operated by DSC as an industrial park, installing a security fence, and implementing drainage controls. In 2000, the OU2 RI began; it included the collection of soil, sediment, and building surface samples as well as installation and sampling of 12 shallow bedrock monitoring wells. The Feasibility Study (FS) Report for OU2 was completed in April 2004, and the ROD was issued in September 2004. The remedy selected in the ROD included:

- Demolition of buildings and relocation of tenants.
- Excavation of an estimated 107,000 cubic yards of contaminated soil containing Total PCB Aroclor at concentrations greater than 500 mg/kg and contaminated soils that exceed New Jersey's Impact to Groundwater Soil Cleanup Criteria (IGWSCC) for contaminants other than Total PCB Aroclor.
- Treatment within OU2 of excavated soils amenable to treatment by Low Temperature Thermal Desorption (LTTD), followed by backfilling of excavated areas with treated soils.
- Transportation of contaminated soil and debris not suitable for LTTD treatment to an off-site facility for disposal, with treatment as necessary.
- Excavation of an estimated 7,500 cubic yards of contaminated soil and debris from a Capacitor Disposal Area and disposal off-site, with treatment as necessary.
- Installation of a multi-layer cap or hardscape.
- Installation of engineering controls.
- Restoration of property.
- Implementation of institutional controls.

In 2006, the OU2 remedial action began with the relocation of tenants, followed by the demolition of the former CDE facility structures, which was completed in 2008, and excavation

of the capacitor disposal area. In 2009, soil remediation commenced, which included: excavating, treating and/or disposing of contaminated soil from the former CDE facility; installing a multi-layered cap; and constructing a storm water conveyance system and detention basin. Site restoration and paving activities were substantially completed in September 2012.

Groundwater contamination was investigated as OU3. The RI commenced at the former CDE facility in 2000 included installing and sampling 12 monitoring wells, and the results documented concentrations of VOCs, PCB Aroclors, pesticides, and inorganics in bedrock groundwater. In 2008, EPA initiated a monitoring well installation program that constructed eight bedrock wells to a depth of 150 feet below ground surface (bgs). Seven of the eight wells were multiport wells.<sup>1</sup>

In 2009, EPA continued the OU3 RI with the installation of 14 bedrock monitoring wells, four of which were cored for lithologic characterization and rock matrix diffusion sampling. The well depths ranged from 65 feet to 600 feet bgs, and were completed with multiport sampling devices. Immediately upon completion of drilling, the team conducted a suite of geophysical analyses including: caliper logging; fluid temperature and resistivity; intra-borehole vertical flow under ambient and pumping conditions; and acoustic televiewer logging. Hydraulic conductivity profiling of the boreholes was completed, and discrete fracture network transmissivity calculations were performed to quantify the fracture network properties in the Discrete Fracture Network (DFN) model.

In addition to the existing network of 12 shallow bedrock wells of traditional, open hole construction, and 8 previously installed multiport wells, the 14 new wells completed a monitoring network comprised of 34 wells with 137 discrete sampling intervals. The OU3 RI revealed a groundwater flow regime in highly fractured bedrock, with significant partitioning of VOC and other compounds into the immobile domain (pore spaces) of the Passaic Formation (consisting of shale, mudstone and sandstone locally). The investigation also revealed several high capacity water supply pumping centers that exert significant control over the regional groundwater flow regime, several of which have been intermittently operational since the releases occurred at the former CDE facility. These hydraulic influences led to an extensive, area-wide VOC groundwater plume, and allowed for a wider distribution of mass into the immobile domain. EPA issued the OU3 ROD in September 2012. The remedy selected in the ROD included institutional controls and long-term monitoring of groundwater and vapor intrusion, and incorporated a waiver of groundwater ARARs due to technical impracticability. The OU3 ROD also identified the potential for contaminated groundwater discharge to surface

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<sup>1</sup> NJDEP investigated the presence of tetrachloroethylene (PCE) and TCE, their associated degradation byproducts (DCE, 1,1-Dichloroethene, and vinyl chloride), and other VOCs (*i.e.*, carbon tetrachloride and chloroform) in residential wells to the south and west of the former CDE facility in the late 1980s. The OU3 RI data were inclusive as to whether several of the wells in this area could have been impacted by groundwater contamination from the former CDE facility.

water at levels that would pose an unacceptable risk. Specifically, the OU3 ROD required the further assessment of the potential for release of PCBs from the groundwater to surface water, and deferred to the OU4 remedy a decision on contaminated groundwater that had the potential to discharge to the stream.

## **Site Characteristics**

### ***Physical Characteristics of the Site***

Prominent site features in the OU4 Study Area include:

- Shepherd Avenue Bridge (RM-1.6)
- Confluence of Bound Brook and Green Brook (RM0)
- Bound Brook Bridge (RM0.4)
- South Avenue Bridge (RM2.2)
- New Market Pond dam (RM3.4) – western side of pond
- New Market Pond boat ramp (RM4.1) – eastern side of pond
- Unnamed tributary near New Brunswick Avenue (confluence at RM4.7)
- Clinton Avenue Bridge (RM5.2)
- Unnamed tributary near Elsie Avenue (confluence at RM5.5)
- Confluence of Bound Brook and Cedar Brook (RM5.75)
- Manmade dam (RM6.0)
- Lakeview Avenue Bridge (RM6.2) near the former CDE facility
- Twin Culverts (RM6.55) near the former CDE facility
- Belmont Avenue Bridge (RM6.8)
- Woodbrook Road Dump Superfund Site (RM7.4 to RM7.8)
- Talmadge Road Bridge (RM8.3)

An aerial map with these features highlighted is provided in Figure 3.

The Shepherd Avenue Bridge on Green Brook, located approximately 1.6 miles downstream of the confluence with Bound Brook, is the downstream extent of the OU4 Study Area (Figure 3, Sheet 1). The 1.6-mile stretch of Green Brook has comparatively higher flows and its sediment bed consists of coarse-grained material. The floodplain uses in this area are characterized as residential and public land, similar to the Green Brook's confluence with Bound Brook. Mountainview Park borders the north bank of Bound Brook from RM0 to RM0.4, while the south bank of Bound Brook is residential (Figure 3, Sheets 1 and 2). Downstream of New Market Pond, Bound Brook is comparatively shallow and its bed consists of coarse-grained material. Five road bridges cross the brook downstream of New Market Pond, including: Bound Brook Bridge, Lincoln Avenue Bridge, Conrail Railroad Bridge at RM2.0, South Avenue Bridge, Prospect Avenue Bridge, and New Market Road (County Route 665), as shown on Figure 3, Sheets 2 and 3. Two manmade structures are present in Bound Brook, consisting of former utility pipes and a former weir (Figure 3, Sheet 2). The brook downstream of the pond flows through a

residential neighborhood with some light industrial/commercial use and is surrounded by forested lands (Figure 3, Sheets 1 through 3).

New Market Pond is a constructed impoundment that stretches from RM3.4 to RM4.1 (Figure 3, Sheets 3 and 4). Washington Avenue crosses the pond at RM3.7. The pond originally served as a mill pond and was constructed in the early nineteenth century. The pond was dredged in 1985-1986; the projected depth after dredging was 3 feet on the eastern side, transitioning to 6 feet on the western end by the dam. During dredging, a sediment trap was constructed at the inlet to New Market Pond by Piscataway Township. Following dredging, Piscataway developed the area surrounding the pond into a park, constructing gazebos, installing sprinklers, and rebuilding the dam (and removing remnants of the former mill). Currently, New Market Pond covers approximately 17.6 acres and is bounded by parklands for recreational use on all sides except the north bank, which is bounded by an active railroad track.

Upstream of New Market Pond, three road bridges cross Bound Brook, including: New Brunswick Avenue, Clinton Avenue Bridge (Figure 3, Sheet 4), and Lakeview Avenue Bridge (Figure 3, Sheet 5). This stretch of the brook is surrounded by industrial facilities (such as MRP Steel Fabrication & Engineering near the New Brunswick Avenue Bridge), cemeteries (such as Holy Redeemer Cemetery that stretches along the north bank from New Brunswick Avenue to Clinton Avenue), and wetland areas. Debris fields (cinderblock, rip rap, rocks or other hard debris) are common in this stretch of the brook. A manmade dam is present at RM6.0 (Figure 3, Sheet 5).

The confluence of Bound Brook and Cedar Brook occurs at RM5.75 (Figure 3, Sheet 5) in a wetland and parkland area known as Veterans Memorial Park. Approximately one-half mile upstream Cedar Brook from the Cedar Brook/Bound Brook confluence is Spring Lake (Figure 3, Sheet 5 and 6), a constructed impoundment that is surrounded by Spring Lake Park (Monument Park, nearby to Veterans Memorial Park) is located just downstream of the spillway on Cedar Brook). The lake originally served as a mill pond when constructed in the nineteenth century. Spring Lake is indicated on nineteenth century maps and depicted in period photographs; the lake varied in shape to some extent during this period. Accumulating silt deposits, compounded with drought and groundwater wells installed by Middlesex Water Company, caused the lake to begin to dry up in the 1950s. In the 1970s, plans to rehabilitate the lake were developed. The Middlesex County Mosquito Commission dredged Cedar Brook and Spring Lake from above the lake to the confluence of Cedar Brook/Bound Brook in the 1970s. Design of the current lake (estimated at 6.5 acres) and surrounding parkland began in the 1983; the current lake was constructed in 1985.

Two railroad bridges cross Bound Brook adjacent to the former CDE facility, which is located between RM6.2 at the Lakeview Avenue Bridge and RM6.55 at the twin culverts (Figure 3, Sheet 5). A footbridge also crosses the brook at RM6.25 (Figure 3, Sheet 5). Upstream of the twin culverts, an outfall that flows from Spicer Avenue and along the southeast side of the

former CDE facility merges with Bound Brook at RM6.65 (Figure 1-6bb). The former CDE facility is bounded on the northeast by Bound Brook and the former Lehigh Valley Railroad, Perth Amboy Branch (presently Conrail); on the southeast by Bound Brook and a property used by the South Plainfield Department of Public Works; on the southwest, across Spicer Avenue by single family residential properties; and to the northwest, across Hamilton Boulevard by mixed residential and commercial properties. The land use transitions to residential upstream of the Belmont Avenue Bridge (Figure 3, Sheet 7). Several ball fields and recreational areas along Kenneth Avenue border Bound Brook (Figure 3, Sheet 7). These ball fields are located on a former South Plainfield municipal landfill. At RM7.4, Bound Brook passes an active South Plainfield municipal recycling and yard waste drop-off center. The upstream extent of the OU4 Study Area is the Talmadge Road Bridge at RM8.3 (Figure 3, Sheets 7 and 8) located in Edison, New Jersey. In general, this area is surrounded by wetlands, forests lands, and urban areas. Three former facilities were identified, located outside the OU4 Study Area but near Bound Brook or a tributary upstream of the former CDE facility, including: Tingley Rubber Corporation (a former manufacturer of rubber footwear), Gulton Industries, Inc./Hybrid Printhead (a former industrial site), and Chevron Chemical Company/Ortho Division (a former pesticide manufacturer) and adjacent industrial properties (Figure 3, Sheet 8). Note that the OU4 Study Area upstream of RM7.4 includes only the Bound Brook corridor, since the floodplains are being managed as part of the Woodbrook site. The OU4 Study Area also includes two major tributaries: the unnamed tributary near New Brunswick Avenue at RM4.7 (Figure 3, Sheet 4) and the unnamed tributary near Elsie Avenue at RM5.5 (Figure 3, Sheet 5).

Investigation of OU4 physical characteristics consisted of probing sediments to evaluate sediment texture and unconsolidated sediment depth on transects spaced every 100 feet throughout the Study Area; the analysis of sediment core samples for physical properties (*e.g.*, moisture content, bulk density, grain size, Atterberg Limits); bathymetric and side scan sonar surveys to map water depth and surface sediment texture in New Market Pond; cross-section surveys of Bound Brook; and the installation and monitoring of water level elevations in Bound Brook, its tributaries, and New Market Pond from May to December 2012. Flow measurements were also collected on a monthly basis from each water level location. These data and other datasets were used to set up and calibrate a hydraulic model and sediment transport model to support the OU4 Feasibility Study and allow characterization of net erosional/net depositional characteristics on an overall reach-by-reach (between surveyed cross-sections) basis.

### ***Sediments***

Analytical results revealed the presence of PCB contamination in the sediments of Bound Brook, generally extending from the upstream boundary of the former CDE facility to the dam at the downstream end of New Market Pond in Piscataway (a distance of approximately 3.3 miles along Bound Brook). PCB Aroclor 1254 concentrations ranged from a maximum detection of 85 milligrams per kilogram (mg/kg) in the vicinity of the former CDE facility to approximately 4.4

mg/kg in New Market Pond. Concentrations downstream of the New Market Pond dam decreased markedly to approximately 0.23 mg/kg at Bound Brook's confluence with Green Brook; concentrations in Green Brook ranged from non-detect to 0.16 mg/kg. These findings are consistent with prior EPA sampling of Bound Brook; however, the majority of the sediment samples analyzed previously was collected from the vicinity of the former CDE facility. Refer to Figure 6 for a summary of Aroclor 1254 concentrations detected in the low resolution sediment cores collected throughout the study area.

PCB analyses of recently-deposited sediments confirmed that contaminated sediments were being transported along Bound Brook during the RI investigation timeframe and suggest that New Market Pond is acting as a sediment trap for solids and contaminants transported downstream. Sediment probing, radiological-dated surface sediment samples, and low resolution sediment cores also revealed that at least two isolated pockets of contaminated sediment are present just downstream of New Market Pond. These locations likely represent the first areas downstream of the New Market Pond dam where the flows and shear stresses decrease to a point such that fine-grained solids (and associated contaminants) in the water column have an opportunity to settle after flowing over the dam. Data from sediment core samples and recently-deposited sediment samples indicate a significant decreasing trend in PCB concentrations with increasing distance downstream of the New Market Pond dam.

Evaluation of Total PCB (congener) data from recently-deposited sediment samples revealed that the highest detected concentrations were located adjacent to the former CDE facility (24 mg/kg). Conversely, PCB concentrations averaged 1.6 mg/kg in samples collected upstream of the former CDE facility at the Belmont Avenue Bridge, ruling out the existence of an upstream source that could explain the PCB concentrations detected proximal to the former CDE facility. In addition, principal components analyses and homologue pattern evaluations indicated that upstream PCB levels are dominated by hexachlorobiphenyl homologues, unlike PCB contamination detected proximal to and downstream of the former CDE facility, which is dominated by pentachlorobiphenyl homologues. Similar findings of low PCB concentrations with a homologue signature distinct from that attributed to the former CDE facility were encountered in samples collected from Cedar Brook, other tributaries to Bound Brook, and the portion of Green Brook upstream of its confluence with Bound Brook.

To evaluate the depositional history of sediment contamination in Bound Brook, a high resolution (finely-segmented; approximately 3-5 cm depth sampling intervals) sediment core was collected from a location in New Market Pond anticipated to be continuously depositional based on sediment probing data, observed flow regimes, and historical dredging records. The sediment samples from the high resolution core were analyzed for radionuclides to allow an approximate depositional year to be assigned to each segment. The depositional chronology of Total PCB (congeners) in the high resolution sediment core mirrors the history of the former CDE facility, which operated from 1936 to 1962. The absolute concentration of Total PCB in the high

resolution sediment core peaks sharply circa 1956 to 66 mg/kg, and concentrations subsequently decline to 11 mg/kg in the core top sample. This chronology suggests that New Market Pond sediments in 1956 were characterized by PCB concentrations that were about a factor of 5 higher than the current surface sediment concentration. It should be noted that other areas on the periphery of New Market Pond that were not dredged by the Town of Piscataway in 1985-1986 may contain comparatively elevated PCB concentrations, similar to the peak concentration observed in the high resolution sediment core.

A comparison of current and historical surface sediment data (1997-2011) revealed little change in Aroclor 1254 concentrations over the past 14 years, suggesting limited natural recovery of PCB contamination in Bound Brook. This observation is consistent with trends in the PCB concentrations observed in sediments deposited in New Market Pond over the past 20 years and detected in the high resolution sediment core. Under current conditions in Bound Brook (which assumes that no additional PCB contaminant load enters the system), Total PCB (congener) concentrations are naturally attenuating with a half-life on the order of 50 years. Consequently, if the current Total PCB surface sediment concentrations are approximately 10 mg/kg in New Market Pond, it would take four half-lives (or 200 years) for the future Total PCB concentration to be reduced to less than 1 mg/kg, assuming that current conditions in Bound Brook remain unchanged.

### ***Floodplain Soil***

The OU4 RI included an investigation of Bound Brook floodplain and bank soils for contamination, via soil borings positioned on transects extending out from the brook and along gridded areas positioned near the confluence of Bound Brook and Cedar Brook. The highest Aroclor 1254 floodplain soil concentrations were detected downstream of the former CDE facility, in the floodplains between the confluence of Bound Brook and Cedar Brook (with Aroclor 1254 concentrations detected up to 70 mg/kg on the banks). The area of the Cedar Brook/Bound Brook confluence, and a manmade dam between the former CDE facility and the confluence, are the first significant depositional zones downstream of the former CDE facility. The RI data suggest that Aroclor 1254 soil contamination is being transported from the brook to the floodplains during flooding events. Refer to Figure 7 for a summary of Aroclor 1254 concentrations in floodplain soils at the confluence of Bound Brook and Cedar Brook.

The area surrounding the confluence of Bound Brook and Cedar Brook is also the location of Veterans Memorial Park in South Plainfield. Interim remedial measures conducted at the park by the Borough of South Plainfield in 2003 to address suspected asbestos-containing tiles and sheets and other tarry material included excavation and off-site disposal of debris and contaminated soil (followed by capping with certified clean topsoil) and institutional controls designed to limit public access to the floodplains between Bound Brook and Cedar Brook. In the surface soils at Veterans Memorial Park, the highest detected Aroclor 1254 concentration (2013

OU4 RI data) was 1.8 mg/kg; historically, surface soil concentrations at the park were reported as less than 1 mg/kg Aroclor 1254. Data from residential properties located near the park also characterizes surface soil concentrations as less than 1 mg/kg Aroclor 1254.

### ***Capacitor Debris***

The OU2 (former CDE facility) remedy addressed total PCB concentrations greater than 500 mg/kg as principal threat waste. This material was excavated and either treated on-site using low-temperature thermal desorption (LTTD) followed by backfilling of the treated material or, for those materials not amenable to treatment, disposed of off-site. The OU2 facility contained large disposal areas containing tens of thousands of discarded capacitor casings and parts contaminated with PCBs, which were excavated for off-site disposal without treatment. During the LTTD treatment process, intact capacitors and larger capacitor parts proved to be difficult to treat, and much of this material was sorted out of the soil and also transported off site for disposal. Remaining "low-level wastes" were left on-site under a multi-layer cap.

The OU2 remedy encompassed the entire 26-acre developed CDE facility, which at the time of the ROD was a fully-occupied industrial facility, zoned for industrial/commercial use. It retains the same zoning today, and the expected future land use (per South Plainfield redevelopment plans) includes commercial use.

During the RI for OU2, capacitors were discovered in the floodplain/wetland area between the OU2 facility and the Bound Brook streambed. The region concluded that these buried capacitors should be addressed separately, given the different potential land uses and exposure scenarios potentially available for floodplain soils outside of the boundaries of the former facility.

During the OU4 RI, near the boundary of the OU2 soil excavation and remediation area, deep soil borings were advanced to a depth of about 10 feet (300 cm) below grade at four locations at the top of the bank of Bound Brook. The deep soil borings were advanced to determine the vertical extent of capacitor waste previously observed in test pits excavated by EPA contractors in 2008, with final boring locations adjusted for the limits of OU2 soil remediation and associated observations and OU2 post-excavation sidewall sampling results. An Aroclor 1254 concentration of 3,000 mg/kg, encountered in one of these borings, marks the highest PCB concentration detected during the OU4 RI. Moreover, capacitor waste was observed in the borings, confirming that waste is still present in the banks of Bound Brook adjacent to the former CDE facility. While the bank armoring and geotextile installed by EPA are expected to prevent bank erosion, PCB contamination may be leaching from the bank soils and debris into Bound Brook.

### ***Site Geology and Hydrogeology***

The surficial geology of the OU4 Study Area is composed primarily of alluvial and glaciofluvial deposits. Downstream of New Market Pond, the stream bed is composed of mainly coarse-grained sediments. Weathered bedrock borders a band of alluvium material at RM3.5, centered along Bound Brook. Rock outcrops were visible along the banks of Bound Brook downstream of New Market Pond and near RM3. Glaciofluvial deposits lie to the north of the alluvium material. The band of alluvium deposits extends through RM5, with the stream beds consisting of fine-grained sediments accumulating behind the New Market Pond dam. Eolian material appears at RM3.6 and continues through RM5.0.

By RM6.0, the alluvial deposit narrows and is pinched out by glaciofluvial material and weathered shale, mudstone and sandstone. Rock outcrops of the Passaic formation were visible in the field along the banks of Bound Brook near the former CDE facility, with the stream bed consisting of weathered, fractured bedrock. These formations dominate until RM6.2, when a thin band of swamp and marsh deposits appears. Upstream of the former CDE facility, the field along the banks of Bound Brook is a *phragmites*-dominated wetlands, with observable seeps. (These wetlands have been characterized as scrub/shrub, herbaceous, and forested wetlands). This alluvial deposit is bordered to the north by glaciofluvial material and to the south by weathered shale, mudstone, and sandstone. The swamp and marsh deposits begin to expand at RM7.2, ultimately filling in the southern part of the OU4 Study Area by RM7.5 and thinning the zone of glaciofluvial material to the north. At RM7.5 the OU4 Study Area narrows to only include Bound Brook and remains confined to the brook until the eastern end at the Talmadge Road Bridge. This stretch of Bound Brook flows through swamp and marsh deposits.

The Cedar Brook area is mostly composed of alluvium deposits bordered to the east and west by glaciofluvial material. No surficial geology information is available for the Spring Lake portion of Cedar Brook, most likely because Spring Lake is a manmade feature.

The bedrock aquifer investigated as part of the OU3 RI was separated into three hydrogeologic units, or water-bearing zones, identified as the “shallow,” “intermediate,” and “deep.” These zones refer to groundwater depths down to 120 feet bgs, 120 to 160 feet bgs, and 200 to 240 feet bgs, respectively. They were separated into three water-bearing zones based on the location of monitoring points (ports and screened intervals) for the creation of potentiometric surface and chemical distribution maps. These zones were selected based on the location of ports; however, each of the zones selected does not necessarily coincide with where most of the fractures occurred. Each of these zones is hydraulically connected. The potentiometric surface data and chemical concentrations from these ports were also used in the overall interpretation of groundwater flow and VOC distribution at and downgradient of the former CDE facility.

The shallow water-bearing zone is unconfined and extends from the water table to a depth of approximately 120 feet bgs (bedrock). The water table fluctuates seasonally, occurring in the unconsolidated deposits during periods of high recharge and in the underlying bedrock during seasonally low recharge. The groundwater encountered in the unconsolidated deposits is

hydraulically connected to the shallow unconfined bedrock aquifer. Shallow groundwater is also hydraulically connected to surface water bodies including Bound Brook, Cedar Brook, and Spring Lake. Groundwater to a depth of 120 feet bgs moves north and east from the former CDE facility toward Bound Brook, and northwesterly toward the low-lying area at the confluence of Bound Brook and Cedar Brook. To the northeast of the former CDE facility, immediately across Bound Brook, groundwater flow is generally toward the west to a depth of 120 feet bgs, with groundwater discharging to Bound Brook, Cedar Brook and Spring Lake. Groundwater to a depth of approximately 120 feet bgs has the potential to be hydraulically connected (discharging) to Bound Brook near the former CDE facility

Measurements of groundwater elevations between 120 and 160 feet bgs and between 200 and 240 feet bgs indicated that the generalized direction of groundwater movement is to the north with the gradient generally trending northwest near the former CDE facility before turning to the north-northeast as a result of the influence of local pumping centers. Groundwater in water-bearing zones below 120 feet bgs is not hydraulically connected to surface water bodies.

### ***Groundwater***

The RI for CDE OU3 (contaminated groundwater) revealed the potential for transport of contaminated groundwater from the former CDE facility to Bound Brook, based on stream elevation surveys, groundwater modeling, and consideration of current municipal pumping regimes. The OU4 RI characterized the potential for groundwater contaminants to impact Bound Brook via stream flow surveys and passive sampler (porewater and surface water) deployment and analysis. While the sediment beds in Bound Brook currently possess the largest contaminant inventory, the PCB load in groundwater discharging to Bound Brook near the former CDE facility will become a concern in the future as a potential source of recontamination of remediated sediments. Detected Total PCB (congeners) surface water concentrations averaged approximately  $75 \pm 30$  ng/L adjacent to the former CDE facility.<sup>2</sup> This average exceeds the National Recommended Water Quality Criterion of 14 ng/L for Total PCB by a factor of 5. Most of the PCB loading to the water column occurs within one-tenth of a mile downstream of the twin culverts, with Total PCB levels increasing from background levels of 4.8 ng/L to an average of 75 ng/L. Total PCB surface water concentrations are relatively constant downstream of the former CDE facility. A porewater contaminant mass flux to Bound Brook was estimated using a calculated groundwater flux and Total PCB porewater (0-5 cm) concentrations. The Total PCB mass flux increases by a factor of 20 above background in the same one-tenth of a mile interval. The detected presence of volatile organic compounds (VOC) in the porewater and sediments near the former CDE facility provided an additional line of evidence that contaminated groundwater is discharging to Bound Brook. Moreover, elevated Total PCB concentrations in the surface water, porewater, and sediments coincide with Total VOC porewater detections,

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<sup>2</sup> Several passive samplers were installed directly in an outcropping bedrock fracture, yielding higher concentrations that were accounted for in the averaging.

suggesting that chlorinated solvents in the groundwater may be enhancing the mobility of PCBs due to co-solvency.

### ***Municipal Water Line***

Much of the utility infrastructure in South Plainfield dates from the early 20th century, with limited information about its construction or location. During the OU2 soil remediation work, a 36-inch-diameter municipal water line was uncovered. It is currently owned by the New Jersey American Water (NJAW). NJAW records suggest that the water line was installed in 1962, though architectural drawings from before 1920 indicate the presence of a water line in approximately the same location. It is constructed of cast iron and runs across the limits of the former CDE facility from the southwestern corner to the northeastern corner of the property at a depth of approximately 3 to 5 feet bgs.

To protect the integrity of the water line, the OU2 soil excavation removed soil from around the pipe in small sections, with oversight by NJAW. Although the pipeline was not physically damaged during the excavation process, in February 2011, the pipe failed away from the excavation area, flooding the OU2 work area. The water was contained within the excavation and did not result in a release of contaminants from the area, and EPA worked with NJAW to dewater the excavation and repair the broken pipe.

Eventually, the aging of the infrastructure is likely to lead to additional leaks or a rupture in this pipe. The earlier pipe break was addressed with no long-term consequences, because the open excavation areas acted as a retention basin. This would not be true if, in the future, and a pipe break or leak were to rupture the cap. Instead, the break could transport contaminated soils into Bound Brook, compromising the integrity of the OU2 remedy and releasing contaminants into OU4. This concern prompted the evaluation of alternatives to prevent, or substantially reduce the likelihood of a break in the future.

### ***Known or Suspected Sources of Contamination***

Much of the contaminant mass present in OU4 was released decades ago (CDE was operating from 1936 to 1962) and has slowly dispersed into the environment through natural fate and transport processes. A summary of contamination within each of the major environmental media at OU4 is provided below.

Sediment: Bound Brook sediments were impacted by historical disposal of capacitors and process waste in the banks of the brook; erosion and transport of contaminated surface soils from the former CDE facility via storm run-off into the brook; and on-going discharge of impacted groundwater to the brook. Although the closure of the former CDE facility and recent remedial action at OU2 reduced the discharge of contaminants to the brook, a significant volume of contaminated sediment remains in the brook and capacitor debris remains buried in the banks adjacent to the former CDE facility. Impacted groundwater continues to discharge to the brook.

Contaminated sediments have been carried downstream by surface water flows and have accumulated in low flow areas in the brook, in silt traps, and behind man-made dams and culverts along the brook. The thickest sediment deposits exist in an approximately 3-mile stretch between New Market Pond and the former CDE facility. The majority of the sediment contaminants are persistent and do not degrade readily under most conditions. While some of the contaminants may disperse through erosional forces in the brook (primarily under high flow conditions), estimates of contaminant half-lives from the high resolution sediment core collected in New Market Pond suggest that the sediment PCB half-life is on the order of 50 years, if the conditions associated with the last 20-30 years persist into the future. In general, for the cores examined, the highest concentrations of Aroclor 1254 were measured at the top of the core, and burial via deposition of relatively “cleaner,” more recent solids was not observed.

Floodplain Soil: Floodplain soils are contaminated due to transport of contaminated sediment into the floodplains/wetlands surrounding Bound Brook during flooding. With uncontrolled sediment deposits in the brook, the potential remains for continued transport of contaminants to the floodplain soils. Degradation and dispersion of existing contaminants is likely to be minimal.

Surface Water: Surface waters are contaminated primarily from resuspension of contaminated sediments in Bound Brook and erosion of the banks during flooding. Surface water sample results also indicate an impact from contaminated groundwater discharge in the vicinity of the former CDE facility. With uncontrolled sediment deposits in the brook, resuspension and erosion would likely continue to impact surface water quality, along with groundwater discharge.

### **Current and Potential Future Site Uses**

With few exceptions, land adjacent to the Bound Brook corridor was developed into urban/suburban land use many decades ago. The current use of the Bound Brook in Edison, South Plainfield Piscataway and Middlesex is primarily as a natural area, with the several areas of surface water or floodplain (New Market Pond and Veterans Memorial Park) accessible for recreational uses. There is residential development along the Brook at numerous locations.

This section of Middlesex County has experienced a population increase since 1990. From the period of 1990 to 2010, the affected municipalities (South Plainfield, Piscataway and, to a much lesser degree, Edison and Middlesex) have each shown a steady increase in population (e.g., a 7.1 percent population increase from 2000 to 2010 in South Plainfield). Population density for these communities exceeds 2,500 persons per square mile and is considered urban.

**Future Uses:** Future plans regarding land use in the towns and communities along the Bound Brook are important to the determination of reasonably foreseeable uses of OU4, including those that could increase future contact with the stream and its floodplain. The municipalities of South Plainfield and Piscataway, two communities most affected by the Bound Brook, provided

information for the determination of reasonably anticipated future land uses, as did a local environmental group, the Edison Wetlands Association.

**Routes of Exposure and Exposure Scenarios: Direct Contact** Based on current and reasonably anticipated future land uses, the activities common in the area, and the known transport of PCB contamination to various media, three primary exposure scenarios were identified for direct contact with soil and sediment exposure: residential, recreational, and commercial/industrial.

Six human health exposure scenarios were considered to estimate the exposure associated with these types of activities in greater detail. These scenarios were developed, in part, based on information received from the community. The scenarios, summarized here, are discussed in detail in the risk assessment section, below: Recreationists/Sportsmen/Anglers [adults and adolescents (7-18 years old)]; Anglers [adults, adolescents (7-18 years old), and children (0-6 years old)]; Outdoor Workers (adults); Residents [adults and children (0-6 years old)]; Commercial/Industrial Workers (adults); and Construction/Utility Workers (adults).

**Routes of Exposure and Exposure Scenarios: Fish Consumption** The Bound Brook watershed is unique among fishable waterways in New Jersey in having a waterbody-specific advisory of "do not eat," inclusive of both the general population and high risk populations, covering all species of fish and shell fish. The advisory is based upon fish tissue levels of PCBs, which, as of 2006, were consistently the highest measured in the state.<sup>3</sup> This fishing advisory was put in place after EPA began its response at the site, in the late 1990s. The region has worked with New Jersey to maintain "do not eat" signage along the Brook since that time, in English and Spanish.

Public awareness of the PCB contamination, in addition to the fish consumption advisory, has probably resulted in less recreational activity than would occur if there were no consumption advisories. However, fishing has been observed, as has consumption of the catch, despite the advisory. The primary access point for fishing is at New Market Pond.

Estimates of consumption rates for OU4 were based on rates expected to occur if the brook and the biota were not contaminated and in the absence of consumption advisories. This approach is consistent with EPA policy (EPA, 1990a).

In addition to these human uses, the stream and adjacent floodplains serve several wetland functions for the community, including providing floodway buffer areas/flood storage capacity during storm events and acting as essential wildlife habitat, and a wildlife corridor between habitats.

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<sup>3</sup> Routine Monitoring of Toxics in New Jersey Fish, Third Year (2006) of Routine Monitoring Program, New Jersey Department of Environmental Protection Division of Science, Research and Technology.

## Human Health and Ecological Risk Summary

The purpose of the OU4 risk assessment was to provide an evaluation of potential human and ecological health risks, currently and in the future, in the absence of any major action to control or mitigate surface water, sediment, groundwater, floodplain soil, and biota contamination (*i.e.*, baseline risks). The risk assessment was based on the analytical results (chemical and other testing data) of environmental samples collected during many different investigations, starting with sampling in 1997 for EPA's Ecological Evaluation and extending through 2013 when sampling for the OU4 RI was completed. Historical sediment, floodplain soil, biota (*e.g.*, fish, crayfish, and mouse tissue), and toxicity testing data were combined with OU4 RI data (*i.e.*, sediment, floodplain soil, and toxicity and bioaccumulation testing) to form data sets used in the risk assessment. Although historical surface water data are available, only the OU4 RI surface water data were used in the risk assessment, as they represent the most recent samples and span the entire Study Area. The risk assessment also incorporated OU4 RI sediment porewater data and sediment, floodplain soil, and sediment toxicity and sediment and soil bioaccumulation testing data from the OU4 Study Area and two reference areas (*i.e.*, Ambrose Brook and Lake Nelson) selected for the Ecological Risk Assessment (ERA).

Due to the large number of available sediment and floodplain soil samples, and because the nature and extent of chemical contamination throughout the nearly ten mile long Study Area is not homogeneous, multiple exposure units (EU) were established for the risk assessment (refer to Figure 5). EUs were based on physical features of the site and Bound Brook system and historic PCB concentrations, with boundaries adjusted to key landmarks. The potential for adverse human and ecological health effects was evaluated using data sets specific to each EU, to facilitate decisions regarding potential remedial actions. The OU4 Study Area was separated into eight EUs.

The primary site-related contaminants in OU4 are PCBs and chlorinated VOCs. The risk assessment confirmed that there is a potential for adverse human and ecological health effects from exposure to total PCB concentrations, which are relatively wide-spread throughout the OU4 Study Area. The potential for non-cancer hazard from human exposure to total PCB Aroclors in sediment is limited to EU BB5 (adjacent to the former CDE facility), but total PCB Aroclors in floodplain soil, fish fillet, or shellfish was the predominant contributor to a non-cancer Hazard Index (HI) greater than 1 for at least one receptor population at every EU. When evaluated as TCDD TEQ, PCBs in fish fillet or shellfish was the predominant contributor to an unacceptable cancer risk or non-cancer hazard for at least one receptor population at every EU. The human exposure findings are summarized in Table 1. The ERA indicated there is a potential for adverse health effects in ecological receptors from exposure to total PCBs in surface water, porewater, sediment, floodplain soil, and biota at every EU. The ERA findings are summarized in Table 2.

The Baseline Human Health Risk Assessment (BHHRA) did not indicate a potential for adverse human health effects from exposure to chlorinated VOCs; however, the ERA concludes there is a potential for adverse health effects in ecological receptors from exposure to cis-1,2-DCE in porewater and sediment at EU BB5.

### **Remedial Action Objectives and Remediation Goals**

Based on the site-specific human health and ecological risk assessment results, human health and ecological risk is shown for PCBs in fish throughout the entire Study Area. The sediments and floodplain soils are the primary source of the elevated fish tissue PCB concentrations.

Furthermore, two source areas that pose an ongoing threat of release have been identified, groundwater discharging to surface water, and the capacitor debris identified in the banks of the brook adjacent to the site.

Furthermore, PCBs in sediments, soil and debris pose an unacceptable risk through direct contact. Other COCs were also identified under the various recreational, residential and worker direct contact exposure scenarios and considered in the BHHRA, including TCDD, benzidine and dieldrin. However, given the extent of the PCBs found in these media, a response action that addresses PCBs is expected to address other COCs as well. These direct contact risks are predominantly in EUs BB3, BB4 and BB5, from New Market Pond upstream to the former CDE site.

PCBs were also the primary COPC for ecological receptors for sediments and soil. In addition, the groundwater releasing to surface water, which acts as an ongoing source of PCBs to the brook, also discharges cis-1,2-DCE to porewater and surface sediment at levels that may pose unacceptable risk to benthic invertebrates in BB5.

The region has divided OU4 into four distinct components:

- **Sediment/Floodplain Soils (SS)** - Areas of the Bound Brook and floodplains, inclusive of New Market Pond, with elevated PCBs.
- **Capacitor Debris (CD)**– This area is an area of the floodplain adjacent to OU2, a subset of the floodplain soils subject to special consideration because of the elevated levels of PCB contamination in the soil and capacitor debris in this area.
- **Groundwater (GW)** - An area of contaminated groundwater conservatively estimated at 1,600 linear feet of stream channel near the former CDE facility where contaminated groundwater discharges to surface water.
- **Waterline (WL)** - Options for addressing a municipal water line that passes under the OU2 cap and threaten its long-term integrity, and the protectiveness of both OU2 and OU4 remedies.

The CD and GW alternatives address ongoing sources releasing to the Bound Brook, so each of the SS alternatives assumes that CD and GW alternatives will already have been effectively

implemented before the SS work begins. All costs are expressed as net present value. The construction time for each alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate the performance of the remedy with any potentially responsible parties, or procure contracts for design and construction.

Therefore, the following remedial action objectives (RAOs) address the human health and ecological risks posed by PCB-contaminated soil and debris, and releases of 1,2-DCE to surface water, at the site:

- Sediment/Floodplain Soils (SS):
  - Prevent human exposure (direct contact and recreational exposures).
  - Prevent biota exposure, allowing recovery of fish population.
  - Prevent migration of contaminated sediments.
- Capacitor Debris (CD):
  - Remove, treat, or contain principal threat waste to the extent practical.
  - Prevent direct contact (human and ecological receptors).
  - Prevent migration of PCB constituents at unacceptable levels.
- Groundwater Discharge to Surface Water (GW):
  - Prevent releases of groundwater constituents to surface water and sediment at unacceptable levels.
- Municipal Water Line (WL)
  - Ensure protectiveness of the OU2 and OU4 remedies.

### ***Remediation Goals***

**Sediments and Floodplain Soil** - The region plans to use 1 milligram per kilogram (mg/kg) total PCBs as the remediation goal for sediments and floodplain soil in the Study Area.

**Capacitor Debris** - This area is made up of floodplain soils located between the OU2 cap and the Bound Brook, so the PRG for addressing this area is the same as for the floodplain soils, 1 mg/kg PCBs. This area also contains large quantities of capacitor debris and has been identified as principal threat waste (PTW), given the high concentrations of PCBs in close proximity to surface water. Based upon EPA guidance, for sites in industrial areas, PCBs at concentrations of 500 mg/kg or greater will generally constitute a principal threat, and this was the region's PTW threshold for OU2. For sites in residential areas, principal threats will generally include soils contaminated at concentrations greater than 100 mg/kg PCBs. For the CD areas, floodplain soils outside of the boundaries of the former facility, the region is using the more conservative guideline of 100 mg/kg total PCBs to define PTW for OU4, as opposed to the 500 mg/kg value used for OU2. The 100 mg/kg PTW threshold was used for the Woodbrook site. The difference between 100 mg/kg and 500 mg/kg is expected to have little effect on the cost of the CD

alternatives, because the region expects that there is little difference in volumes between these two values.

**Groundwater** - For discharge of groundwater to surface water, the remedial action objective leads to a preventive goal of eliminating the potential for PCB releases to surface water through a groundwater transport pathway. VOC transport to surface water is also occurring (primarily 1,2-cis-DCE, a degradation byproduct of TCE), with some limited, localized exposure concerns. But the VOCs mobilize the PCBs, and it is the PCBs, and not the VOCs themselves, that are the primary concern of this component of the remedy. Thus, the remedial alternatives considered address both VOCs and PCBs, with the goal of eliminating PCB loading into stream sediments and surface water. Based upon site-specific modeling, even low levels of PCB releases through this pathway could result in unacceptable exposures in sediments and surface water if perpetuated over the long term. The PRG for this groundwater pathway would, therefore, be evaluated in the same way, by preventing releases to surface water that would result in sediment concentrations in excess of the sediment PRG of 1 mg/kg.

### **Description of Remedial Alternatives**

Remedial alternatives were developed for each subarea of OU4, and then combined to form single site remedial alternatives. The alternatives considered are organized according to the four remedial components developed for OU4. All costs for each of the alternatives are expressed as net present value. The construction time for each alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate the performance of the remedy with any potentially responsible parties, or procure contracts for design and construction.

### **Description of Sediment/Floodplain Soils (SS) Alternatives**

Bound Brook sediments and floodplain soils outside the CD areas contain PCB concentrations ranging up to, and in some cases exceeding, 100 mg/kg. Because PCB levels in excess of 100 mg/kg are infrequent, the region is considering this material "low-level threat" wastes, and considered removal and capping options, but not treatment.

**The "Reaches:"** The FS divides the study area sediments and their adjacent floodplains into sections, or "reaches," as follows (see Figure 8):

- Reach 1A and 1B are reaches upstream of the CDE facility. Reach 1A is upstream in Bound Brook, and Reach 1B is upstream in Cedar Brook and Spring Lake, in areas outside the limits of Bound Brook flooding.
- Reach 2 includes the section from RM6.55 to New Market Pond.
- Reach 3 includes New Market Pond.
- Reach 4 includes all the areas downstream of New Market Pond.

The RI showed that Bound Brook is characterized by shallow bedrock, relatively thin layers of unconsolidated sediment, and shallow base flow water depths; therefore, removal options are more desirable for contaminated sediment than capping. As discussed below, capping is considered for contaminated floodplain soils but the region has concerns regarding the performance of a cap during potential flooding events and even under typical drainage conditions in the floodplain. In addition, because the areas near Bound Brook and downstream are already stressed by a lack of stormwater drainage capacity, capping that would further reduce flood storage capacity would be unacceptable. Three alternatives were considered:

- Alternative SS-1: No Action
- Alternative SS-2: Excavation/Dredging of Sediments and Soils
- Alternative SS-3: Excavation/Dredging of Stream Sediments, Excavation with Capping of Floodplain Soils, Dredging with Capping of New Market Pond, Limited Hotspot Dredging of Depositional Areas with Monitored Natural Recovery

Alternative SS-2 would rely on dredging or excavation to remove contaminated material, followed by restoration of disturbed areas. Alternative SS-3 would include dredging or excavation in certain areas combined with capping and monitored natural recovery (MNR).

#### ***Common Elements for SS Alternatives***

All of the remedial alternatives except Alternative 1 include long-term monitoring and institutional controls to limit future land uses. The degree of monitoring that would be needed is different for each alternative. Alternatives SS-2 and SS-3 would both incorporate institutional controls, which are administrative and legal controls that help to minimize the potential for human exposure to contaminants, such as the fish advisory already in place. For Alternative SS-3, institutional controls consisting of restrictions on land use of capped floodplains soils would be implemented. If wastes are left on the site, or if the time required to achieve the RAOs is greater than five years, five-year reviews would be conducted to monitor the contaminants and evaluate the need for future actions.

The active remedies rely on monitored natural recovery to aid in achieving the remedial objectives. The PRG of 1 mg/kg total PCBs is not adequate, on its own, to achieve a protective level for a  $10^{-4}$  incremental lifetime cancer risk for fish consumption, which would require a PRG in the range of 0.25 to 0.38 mg/kg. The region expects that by addressing PCB-contaminated sediments and soils at levels in excess of 1 mg/kg and eliminating ongoing sources of contamination to the sediment (the CD area and the groundwater discharging to Bound Brook), the OU4 remedial action, including natural recovery at the rates suggested by the high-resolution coring data, will reduce contamination in fish tissue to protective levels within a reasonable timeframe, conservatively estimated at 100 years.

#### **Alternative SS-1: No Action**

Total Present Value	\$0
Construction Time Frame	0 years

Regulations governing the Superfund program require that the “no action” alternative be evaluated to establish a baseline for comparison to other alternatives. Under this alternative, EPA would take no action at OU4 to prevent potential exposure to sediment and soil contamination.

#### **Alternative SS-2: Excavation or Dredging of Sediments and Excavation of Soils**

Total Present Value	\$210,000,000 to \$220,000,000
Construction Time Frame	2 to 3 years

This alternative would remove contaminated sediment from Bound Brook and New Market Pond, and contaminated soil from the surrounding floodplain, thereby preventing human exposure and controlling impacts to the environment. Options considered for removing material consist of dredging sediments in the wet or diverting the Bound Brook and excavating contaminated sediments "in the dry," coupled with conventional excavation of floodplain soils. The majority of the contaminated sediments, an estimated 34,000 cubic yards, are located between RM6.55 (the twin culverts) and New Market Pond. The majority of the contaminated floodplain soils, an estimated 260,000 cubic yards, are located near the OU2 facility, and near the confluence of Bound Brook and Cedar Brook, adjacent to and including portions of Veteran's Memorial Park.

Two methods were considered for removing contaminated sediments, dredging and excavation:

**Stream Dredging:** Contaminated sediment from the brook would be mechanically dredged through the use of cranes and environmental buckets, excavators, drag line, and other equipment mounted on an amphibious vehicle operating in the brook. Floodplain soils would be excavated using conventional construction equipment with appropriate controls and modifications for wetland/soft soil areas (*i.e.*, track-mounted, low pressure or high floatation vehicles). Backfill would be placed in disturbed areas to restore the streambed and floodplain to pre-removal grades, to cover and isolate dredging residuals or remaining contaminants in the soil, to provide material for habitat restoration, and to restore surface water drainage patterns. Disturbed areas would be regraded and backfilled with material suitable for habitat restoration. Armoring would be provided as necessary to control erosion.

Dredged sediments and excavated soils would be transported to a central processing site for processing prior to shipment off-site for ultimate disposal. At the processing site, sediment and soil would be segregated based on the characteristics of the material as determined during the design phase. Sediment and floodplain soil would be processed as necessary for disposal or beneficial use, such as daily landfill cover. Processing steps

would include dewatering to a moisture content required for additional processing or disposal of dredged solids. Either passive or mechanical dewatering could be used. Material characterized as hazardous or as TSCA waste would be stockpiled separately from material classified as non-hazardous; material requiring processing prior to disposal would be stockpiled separately from material not requiring processing. The processed solids would be shipped to an off-site disposal facility.

**Stream Excavation:** This would remove contaminated sediment from Bound Brook by dewatering the streambed and removing the contaminated sediment “in the dry.” Conventional excavation would be used to remove contaminated floodplain soils. Surface water flow in Bound Brook would be temporarily diverted around the active work area to allow conventional excavation of sediments under relatively dry conditions, rather than dredging. Excavation of the sediment in the dry allows greater control over sediment removal because of greater access, reduces the post removal processing requirements due to the lower moisture content of the sediment, and minimizes the potential for dredging-related sediment resuspension and contaminant migration.

The brook would be divided into segments based on natural boundaries at the site (*e.g.*, culverts, bridges, dams, etc.). Working segment by segment, a pumping and pipeline system would be constructed to dewater the brook. Temporary coffer dams would be installed across the brook and the surface water pumped through a temporary pipeline around the active portion of the work. Following dewatering, contaminated sediments would be removed from the bed of the brook using cranes, conventional excavators, drag line, and other construction equipment. The excavated sediment would be characterized for disposal and shipped to an off-site disposal facility. Once excavation of a segment was completed, backfill would be placed in disturbed areas to restore the streambed to pre-excavation conditions and allow for habitat restoration in the brook.

Diverting the stream and excavating sediments allows for marginally better sediment management performance during the removal, and appears to be a better fit with several of the groundwater alternatives, and is also less costly. Stream diversion and excavation was assumed, for cost-estimating purposes for this alternative. However, it is possible that a combination of excavation and dredging would be used.

While it would be technically feasible to dewater New Market Pond and excavate the sediment in the dry, this approach has a number of drawbacks, including odors and fish kills. Capturing and releasing fish up or downstream of the pond would allow the spread of PCB-contaminated fish beyond the limits of the fish advisory and increase the likelihood of consumption of the contaminated fish. For this reason, hydraulic dredging is preferred as the process for removing the sediment in New Market Pond necessary to achieve the PRG. Hydraulic dredging is described in more detail in Alternative SS-3.

This alternative comprehensively addresses streambed sediments from approximately RM6.55 (at the twin culverts) down to and including New Market Pond (Reaches 2 and 3). Two depositional area hotspots have also been identified, at RM2.48 And RM 3.03 in Reach 4, which exceed the PRGs. These hotspots would also be addressed in this alternative, probably through dredging. Based upon the 100-foot spacing of transects during the RI, it is possible that other small depositional areas could be identified with further sampling. This alternative includes a provision for further sampling to attempt to identify other hotspots, primarily in Reach 4, and assumes that other identified small hotspots would also be removed.

This alternative includes the cleaning of the existing silt trap (located upstream of the inlet to New Market Pond). After completion of the active remedy, MNR is expected to further improve conditions in surface water and sediments such that concentrations of contaminants in fish tissue would improve to acceptable levels over time. Future maintenance of the New Market Pond silt trap is expected to be advantageous for long-term improvement of fish tissue, as this mechanism (along with New Market Pond itself) has proved to be effective at collecting contaminated sediments. Therefore, this alternative includes the periodic maintenance (through sediment dredging every five years) of the silt trap to aid in the effectiveness of MNR.

To minimize local truck traffic, the preferred method to transport soil and sediment off-site for disposal would be by rail. This would require locating a processing site with a rail spur or siding. The feasibility of constructing a dedicated rail spur at the designated sediment/soil processing site would be evaluated during the RD stage of the project. If a processing site is not available with rail access, trucks may be used.

**Alternative SS-3: Excavation/Dredging of Stream Sediments, Excavation with Capping of Floodplain Soils, Dredging with Capping of New Market Pond, Limited Hotspot Dredging of Depositional Areas with Monitored Natural Recovery**

Total Present Value	\$155,000,000 to \$165,000,000
Construction Time Frame	2 to 3 years

This alternative would also rely on dredging or excavation for much of the contaminated material, similar to Alternative SS-2 (for example, the options for excavation or dredging of stream sediments from RM6.55 to New Market Pond and maintenance of the silt trap would remain unchanged), but this alternative also combines excavation or dredging with capping in several discrete areas of OU4, as described below. (Isolation capping is not suitable for use under the majority of conditions in Bound Brook due to the low flows; the cap would obstruct flow during parts of the year.)

**Hydraulic Dredging and Capping in New Market Pond:** While stream excavation is preferred for most of Bound Brook, hydraulic dredging does represent a feasible option for New Market Pond (Reach 3). Approximately 67 percent (70,000 cubic yards) of the contaminated sediment exceeding the PCB PRG is located in New Market Pond.

Under Alternative SS-3, hydraulic dredging would be used for partial removal of contaminated sediment in New Market Pond, coupled with construction of an engineered cap to isolate the remaining sediments from the environment. Partial removal would entail the removal of enough material from the pond to accommodate the cap thickness without causing additional flooding, followed by construction of a sub-aqueous cap to contain residual contaminants (assumed to be a 24-inch thick sand cap). The depth of dredging would be required to be approximately 6 inches greater than the planned thickness of the cap to maintain water depth. Use restrictions would be established for the capped areas to protect the areas from unnecessary disturbance and to provide for long-term access for cap inspection and maintenance.

**Consolidation/Capping of Floodplain Soils:** Typical upland isolation capping consists of a soil cap a minimum of 24 inches thick, although the cap thickness may increase based on site-specific conditions. Capping would not be suitable in the portions of the floodplain bordering the streambed because of the potential for disrupting normal surface water flow patterns and the need for extensive armoring to protect the cap during high flow conditions. However, capping may be an effective alternative in portions of the broad expanses of floodplain where contamination is laterally extensive (*i.e.*, the area near the confluence of the Bound Brook and Cedar Brook). This would involve fully excavating approximately 15 acres of the floodplains near the stream channel (an estimated 121,000 cubic yards), and removing an additional 30,000 cubic yards of surface soils from the remainder of the floodplain to allow for capping. The total volume excavated would be 151,000 cubic yards.

Under this approach, approximately 42 percent (109,000 cubic yards) of the contaminated floodplain soil would be left in place under a soil cap. The capped area would cover approximately 17 acres (See Figure 9). A minimum two-foot thick cap would be constructed over contaminants in the floodplain using standard construction equipment. The intent of the cap would be to isolate remaining contaminants in the soil from the environment and direct contact, not to control permeability or prevent leaching. The need for armoring of the isolation layer would be evaluated during the RD phase. Prior to capping, a surface water drainage plan would be developed for the area to ensure that the cap did not disrupt current flow patterns or that alternative drainage routes were available. Use restrictions would be established for the capped areas to protect the area from unnecessary disturbance and to provide for long-term access for cap inspection and maintenance.

The capping in New Market Pond and in floodplains would require long-term cap maintenance. A 30-year cap maintenance period has been used for cost-estimating purposes, but the caps would need to be maintained in perpetuity.

**Depositional Area Monitored Natural Recovery:** The OU4 RI identified significant areas within the brook where sediments contained contaminants at concentrations below PRGs. For example, with few exceptions, PRG exceedances were not found in Reaches 1A, 1B and 4, and remedial action will not be required in these areas. However, discrete depositional areas were

identified within these generally low concentration areas (at RM 2.48 and RM3.03), and contaminant concentrations in these discrete depositional areas were found to exceed PRGs. Under Alternative SS-3, sediments hotspots in these discrete depositional areas would not be removed, but addressed by MNR.

### **Description of Capacitor Debris (CD) Alternatives**

The region has defined PTWs for OU4 as soil and capacitor containing debris with concentrations of PCBs in excess of 100 mg/kg located in the floodplain in the CD area. The FS identified seven remedial process options for the CD areas. EPA distilled those options to three “best fit” remedial alternatives. EPA’s “A Guide to Principal Threat and Low-Level Threat Wastes”, November 1991, affirms EPA’s preference for permanent remedies to treat PTWs, wherever practical. Therefore, for CD areas, the capping alternative has not been carried forward, leaving only “no action” and treatment, excavation and disposal alternatives for the OU4 principal threat wastes. The alternatives under consideration consist of:

- Alternative CD-1: No Action
- Alternative CD-3: Full-depth Excavation, Thermal Desorption, and On-Site Burial of Residuals
- Alternative CD-4: Full-depth Excavation and Off-Site Disposal

Both excavation alternatives (CD-3 and CD-4) involve conventional excavation of CD from the sloped banks of Bound Brook adjacent to the former CDE facility, followed by filling and regrading to restore the banks, and installation of an armored layer to prevent erosion during future flood events. The twin culverts in the Bound Brook channel would also be removed as part of these alternatives to allow access to suspected CD areas and to mitigate the erosional areas caused by the presence of the culverts. Confirmatory sampling would be employed to verify adequate removal, which is expected to be required throughout the entire length of the banks previously armored by an EPA removal action. The primary difference between the excavation alternatives would be the use of on-site treatment and placement of the treated waste below a cap in a disposal area located within the footprint of the former CDE facility (under the OU2 cap) for CD-3, as opposed to off-site disposal for CD-4.

### ***Common Elements of CD Alternatives***

All of the remedial alternatives except Alternative 1 include long-term monitoring and institutional controls to limit future land uses. The degree of monitoring that would be needed is different for each alternative. Institutional controls are administrative and legal controls that help to minimize the potential for human exposure to contaminants. For Alternative CD-3, institutional controls consisting of restrictions on land use of capped floodplain soils would be implemented. (Five-year reviews are already required for the OU2 and OU3 remedies.)

### **Alternative CD-1: No Action**

Total Present Value	\$0
Construction Time Frame	0 years

Regulations governing the Superfund program require that the “no action” alternative be evaluated to establish a baseline for comparison to other alternatives. Under this alternative, EPA would take no action at the site to prevent potential exposure to soil contamination or PCB-contaminated capacitor debris.

### **Alternative CD-3: Full-depth Excavation, Thermal Desorption, and On-Site Burial of Residuals**

Total Present Value	\$25,000,000 to \$30,000,000
Construction Time Frame	1 year

Under this alternative, PTWs with PCB concentrations greater than 100 mg/kg would be excavated and treated by an on-site treatment process, low temperature thermal desorption (LTTD). The potential location of the treatment pad for the on-site treatment unit has not been selected at this time. The 26-acre facility has been designated a redevelopment zone by the Borough, and EPA is supportive of putting the land back to productive use; the location of the treatment facility may depend upon the status of the redevelopment project, and land may need to be leased to provide a footprint for the treatment facility.

The process would begin with excavation of the contaminated soil and debris, using sheeting, coffer dams and other stream diversion techniques as necessary, followed by post-excavation sampling. The volume of material is estimated to be 31,900 cubic yards. LTTD is a physical separation process by which wastes are heated in thermal desorption units to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. Contaminants are removed through condensation followed by carbon adsorption or they are destroyed in a secondary combustion chamber or catalytic oxidizer. For treatment of the OU4 soils, the post-treatment target would be less than 1 mg/kg total PCBs and treated material would be placed on site. Debris that could not be successfully treated would be disposed of off-site. For cost-estimating purposes, it is assumed that approximately 10 percent of the material excavated under this alternative would not need to be treated and could be placed under the cap without LTTD treatment.

Under Alternative CD-3, treated soil and debris would be consolidated into a single location (on the former CDE facility property, if appropriate) and capped with a cap design similar to that used to remediate OU2. The FS estimate assumes that the material would be placed at the former CDE facility in a 10-acre area, which would result in a relatively thin layer (18 inches) of new waste spread over a wide area, to allow for proper drainage of the OU2 property.

This alternative would include capping and engineering controls, institutional controls to restrict land use, wetland restoration and long term Operation and Maintenance (O&M) of the cap. Since wastes would be left on-site, five-year reviews would be conducted to ensure the remedy is protective and evaluate the need for future actions.

#### **Alternative CD-4: Full-depth Excavation and Off-Site Disposal**

Total Present Value	\$15,000,000 to \$25,000,000
Construction Time Frame	1 year

Under this alternative, all CD waste would be excavated and disposed of off-site at an appropriate disposal facility. The excavation would proceed as described above for Alternative CD-3; however, no on-site treatment would be conducted prior to off-site disposal.

#### **Description of Groundwater (GW) Alternatives**

The GW alternatives would mitigate the discharge of contaminated groundwater to Bound Brook adjacent to the former CDE facility. Contaminated groundwater (OU3) is present in the bedrock matrix (as demonstrated by results of bedrock porewater analyses performed during the OU3 RI) and is discharging to the brook. The OU3 RI results, combined with numerical modeling, indicate that contaminated groundwater identified in OU3 has the potential to impact conditions in OU4 for many decades or even centuries to come. The groundwater discharge has the potential to recontaminate remediated sediments in Bound Brook and cause unacceptable risks to ecological receptors.

Remediation of the contaminated groundwater source itself was evaluated in OU3 and was found to be technically impractical. Because groundwater restoration is impracticable, to be protective in the long term, the remedial alternatives should be able to prevent exposure to receptors in perpetuity. This was a primary factor in the development and evaluation of the GW alternatives. The alternatives under consideration consist of:

- Alternative GW-1: No Action
- Alternative GW-2: Monitoring and Institutional Controls
- Alternative GW-3: Hydraulic Control of Groundwater
- Alternative GW-4: Permeable Reactive Barrier (PRB)
- Alternative GW-5: Reactive Cap

Under Alternative GW-2, monitoring the sediment and water quality would be performed in Bound Brook in lieu of active remediation of groundwater discharges. Alternative GW-3 consists of a groundwater withdrawal and treatment system intended to capture and treat the portion of the contaminated groundwater that would otherwise discharge into the brook as contaminated porewater. Alternatives GW-4 and GW-5 are passive treatment systems.

Alternative GW-4 consists of a PRB installed in a trench adjacent to the brook, and Alternative GW-5, a reactive cap installed in the bed of the brook.

Potential alternatives that were examined and determined to be impractical included damming the brook to create an impoundment deep enough to counteract the head of discharging groundwater (the inundation area would have a substantial deleterious effect on surrounding properties) and an impermeable cap in the streambed (models indicate the discharge would shift to a tributary to Bound Brook, where it would continue to cause an adverse impact on the water body). The concept of restarting the Spring Lake well field, which, when operating prior to 2003, created a downward gradient that may have reduced much of the discharge to surface water, was also considered but not retained. The owner of the well field, Middlesex Water Company, does not currently have a business interest in reactivating this system, which operated at a rate of as much as 2 million gallons per day, nearly 1,400 gallons per minute (gpm). In contrast, the pumping system required to achieve capture of the discharging groundwater, as discussed above in Alternative GW-3, would require only 25 gpm, and would be situated so that it will create the needed drawdown across the necessary capture zone, whereas the Spring Lake system would create a much larger drawdown, but not necessarily across the necessary capture zone.

### ***Common Elements for GW Alternatives***

The GW alternatives (with the exception of Alternative 1, No Action) each include long-term monitoring to evaluate groundwater and porewater quality associated with groundwater discharge to Bound Brook. Each of the alternatives also focus only on the portion of the contaminated groundwater that discharges through the bed of Bound Brook, since the rest of the groundwater plume was addressed in the OU3 ROD. Due to the long-term back-diffusion of contaminants from the bedrock matrix and the associated contaminated groundwater discharge, each of the GW alternatives would have to be operated and maintained for the same timeframe, which is expected to be on the order of hundreds of years. Alternatives GW-4 and GW-5 both employ passive treatment technologies to achieve remedial action objectives for the groundwater discharging to Bound Brook, the only difference being the location at which the groundwater is treated – either in a vertical trench adjacent to the brook or at the point of discharge in the bed of the brook via a reactive cap. For Alternatives GW-4 and GW-5, the collected monitoring data would be used to evaluate the frequency of media replacement required in the PRB and reactive cap, respectively, in addition to evaluating achievement of remediation goals and assessing attenuation.

For all the GW Alternatives, five-year reviews would be conducted to ensure the remedy is protective and evaluate the need for future actions. A groundwater use institutional control, in the form of a New Jersey Classification Exception Area (CEA), is already required as part of the OU3 remedy, which addresses the area-wide site-related groundwater contamination. An OU4

groundwater remedy would necessitate the expansion of the planned CEA to include the OU4 area as well.

#### **Alternative GW-1: No Action**

Total Present Value	\$0
Construction Time Frame	0 years

Regulations governing the Superfund program require that the “no action” alternative be evaluated to establish a baseline for comparison to other alternatives. Under this alternative, EPA would take no action at the site to prevent discharge of contaminated groundwater to Bound Brook.

#### **Alternative GW-2: Monitoring, Institutional Controls**

Total Present Value	\$10,000,000 to \$15,000,000
Construction Time Frame	1 year

This alternative consists of monitoring the sediment and water quality in Bound Brook in lieu of active remediation of groundwater discharges. Under Alternative GW-2, the effectiveness of MNR in achieving remedial action objectives for the groundwater discharging to the brook would be evaluated. Institutional controls such as the fish advisory already in place would be maintained to protect against human exposure in downstream areas of the brook.

Monitoring would be initially conducted on a quarterly basis, until baseline conditions are established. Once established, monitoring could be adjusted to a semi-annual or annual frequency, depending on the results. Monitoring would include the following elements: porewater sampling using passive samplers, the installation and sampling of groundwater monitoring wells along the length of the impacted section of the brook (including single- and nested, multi-depth wells), surface water grab samples, installation and monitoring of piezometers, and collection and analysis of sediment samples. Samples would be analyzed for PCBs and VOCs.

#### **Alternative GW-3: Hydraulic Control of Groundwater**

Total Present Value	\$20,000,000 to \$25,000,000
Construction Time Frame	1 year

This alternative would establish hydraulic control (containment) of the portion of the groundwater discharging from the former CDE facility to Bound Brook. Hydraulic control of groundwater would entail installing three vertical extraction wells on the former CDE facility property, each to a depth of approximately 75 feet bgs, and pumping the wells at a combined rate of approximately 25 gpm. The groundwater extraction well depths and total flow rate are based

on preliminary results of a MODFLOW groundwater extraction simulation performed as part of the OU3 RI, and would need to be refined during remedial design (RD).

Alternative GW-3 incorporates an on-site treatment system to treat the extracted groundwater. Although the final technology selection for an *ex situ* treatment system would be deferred to the RD phase, representative process options were selected and included oil-water separation, acidification to control scaling, sediment filtration, oxidation to treat organics, catalytic filtration for metals removal, carbon effluent polishing, neutralization, and discharge to a local municipal treatment works or Bound Brook.

It is expected that Alternative GW-3 would need to be operated for decades or potentially centuries, i.e., as long as contaminants in the bedrock matrix would prevent groundwater from meeting remedial action objectives in Bound Brook. A groundwater monitoring program would be established to monitor the performance of the hydraulic control remedy. Because of the duration of operation, the RD would need to include O&M requirements for the various treatment system components, and to optimize the design based on minimizing O&M costs (*e.g.*, use of solar power). The building housing the treatment components, as well as the piping connecting the various components of the system, would need to be designed for an extended operational life. Contaminant concentrations may fluctuate over time; therefore, this system would need to be flexible enough to allow for use of different technologies, as needed.

#### **Alternative GW-4: Permeable Reactive Barrier**

Total Present Value	\$25,000,000 to \$30,000,000
Construction Time Frame	1 year

Alternative GW-4 consists of a PRB in a trench located on or adjacent to the former CDE facility to intercept and treat contaminated groundwater prior to discharge to Bound Brook. A PRB passively treats contaminated groundwater as it flows through reactive media installed within the trench. Primary design factors for the PRB include: the depth to bedrock, the required depth and breadth of the groundwater capture zone, the residence time required for treatment of the contaminants to desired concentrations, and the treatment media to be installed. On the basis of preliminary modeling results and site conditions documented by the OU3 RI, it is anticipated that the PRB would be approximately 1,500 feet in length, running along the northeast and northwest boundary of the former CDE facility adjacent to the brook.

According to data collected during previous investigations in OU2 and OU3, bedrock is present at depths between 0 to 10 feet bgs at the former CDE facility. Groundwater modeling suggests that the PRB trench would need to be 50 to 75 feet deep to capture the groundwater discharging to the brook. To excavate a trench to that depth, controlled blasting would be used to create a rubble zone in the bedrock. After blasting, if the trench walls were stable, the rubble could be removed. If the trench walls were not stable, it might be necessary to backfill the trench (to stabilize the area) with a combination of treatment media and appropriately selected fill material.

Unstable conditions in the trench could impact the cost of subsequent media change-outs and potentially, the effectiveness of the system.

Controlled blasting would increase the bedrock permeability and is expected to modify the flow paths in the bedrock aquifer in a manner advantageous to the groundwater treatment objective by creating a zone of higher permeability around the trench that should encourage the flow of contaminated groundwater through the treatment media.

The reactive media in the trench would be selected based on the primary constituents of concern and a treatability study would be conducted during the RD. Because it is anticipated that groundwater will continue to discharge contaminants to the brook for decades or longer, the PRB would need to be designed to be maintained and operated over a very long period. Over time, the reactive media in the PRB would be consumed and require replacement.

During the RD, approaches to facilitate media replacement would be evaluated. These may include the use of panels, canisters, or reactors containing treatment media that can be inserted and removed readily; injection of treatment media into the rubble zone created by the blasting; or removing/replacing the rubble zone and directly backfilling treatment media into the trench. The selection of the appropriate option would be finalized based on conditions in the trench. Panels or canisters would allow for more ready replacement of spent media, but are likely to have less treatment capacity and require more frequent change-out. Backfilling the trench with the media would likely have greater treatment capacity between change-outs, but each change-out would be more expensive and labor-intensive. Given the depth of the trench, cranes and booms would be required for either option. The need for equipment access over the life of the treatment process could affect development in a portion of the former CDE facility property. A monitoring program would be required to evaluate the effectiveness of the treatment and detect the need for reactive media replacement.

#### **Alternative GW-5: Reactive Cap**

Total Present Value	\$17,500,000 to \$22,500,000
Construction Time Frame	1 year

Alternative GW-5 consists of installation of a reactive media layer in the bed of Bound Brook to intercept and passively treat contaminated groundwater at the point of discharge. During RD, the optimal sequence for installation of the reactive cap in relation to the remediation of the soil and sediment, and the capacitor debris areas, would be determined.

Constructing a reactive cap could require diverting the water in the brook via coffer dams and a pipeline diversion system (using procedures similar to those discussed for SS-2) and over-excavating the streambed within the known discharge zone to an appropriate depth, such that the top of the reactive cap (including armoring layer) would be at the same grade as the current streambed. Bedrock outcrop areas could require blasting to accommodate the thickness of the

reactive cap, although data from the remediation of OU2 suggests that the upper portion of bedrock is weathered and likely is rippable using conventional excavators.

The reactive material would be installed in manufactured ‘blankets’, with the reactive media sandwiched between two layers of filter fabric. Use of media blankets would facilitate regular removal and replacement of the reactive media. Following installation, the media blankets would be covered with a sand layer to allow habitat to be reestablished in the area. Armoring would be provided for the cap to protect it from erosion during high flows.

A pilot study would be required to determine the required cap thickness. Detailed measurements of the historical and current river flows would be required to establish locations within the cap alignment requiring additional armoring or additional thickness of the sand layer. Porewater flux monitoring, along with multiple rounds of groundwater monitoring, both for the pre- and post-treated groundwater, would be conducted as part of the pilot study.

Based on the results of particle tracking and sediment transport modeling conducted for the OU4 RI, the cap would likely be placed between RM6.2 and RM6.5 of Bound Brook, a distance of approximately 1,600 linear feet, from the twin culverts to the Lakeview Ave Bridge. The cap would encompass the entire width of the brook, extending up the side slopes and anchored along the shore line. The conceptual alignment of the cap is depicted in Figure10.

It is anticipated that the reactive cap will need to remain in place in perpetuity. The life of the treatment media is subject to the contaminant load and the groundwater flux, and the media would require replenishment as part of its O&M cycle. A porewater monitoring program would be established to verify that the reactive cap is treating contaminants in the groundwater prior to discharge to surface water. Contaminant levels in the porewater would be evaluated during the RD to indicate when media change out is required. Alternative monitoring approaches may also be introduced during the RD to monitor system performance.

### **Description of Water Line (WL) Alternatives**

Approximately 1,700 feet of 36-inch diameter ductile iron pipe crosses the former CDE facility property. This high pressure potable water transmission line was uncovered during excavation of OU2, and although it was not physically damaged during the excavation process, the water line ultimately developed a leak during that remedial activity. Although the pipeline was repaired, as the water lines ages, it is possible that it will leak again or break. Depending on the extent of the leak or break, the water could impact the integrity and protectiveness of OU2 soils remedy and release contaminants to Bound Brook. To address this potential threat to the OU2 and OU4 remedies, the alternatives under consideration consist of:

- Alternative WL-1: No Action
- Alternative WL-2: Water Line Monitoring System, Replacement in Existing Easement As Necessary
- Alternative WL-3: Water Line Replacement in New Easement

### **Alternative WL-1: No Action**

Total Present Value	\$0
Construction Time Frame	0 years

Regulations governing the Superfund program require that the “no action” alternative be evaluated to establish a baseline for comparison to other alternatives. Under this alternative, EPA would take no action at the site to address the concerns associated with the existing high pressure water line below the former CDE facility property.

### **Alternative WL-2: Water Line Monitoring System**

Total Present Value	\$3,500,000 to \$4,500,000
Construction Time Frame	1 year

Alternative WL-2 consists of leaving the water line in its current location and installing a pipeline monitoring system to detect leaks in the segment of the pipeline crossing the former CDE facility property. Pipeline monitoring systems for single walled pipes, such as the existing water main, typically involve monitoring the pressure within the pipe. If the pressure drops outside of a designated range, an alarm sounds indicating a leak. The system can either be designed to automatically shut down the segment of the pipeline that the monitoring system indicates has a leak, or the decision on action can be deferred to a designated responder.

This alternative would require the following elements:

- Install a pipeline monitoring system to detect potential leaks in the water line.
- Install a control system that would allow the portion of the pipeline crossing the former CDE facility property to be shut down in the event of a leak.
- Install an alarm and emergency alert system to alert a designated person or team tasked with responding to a leak.
- Establish a program for addressing future leaks.
- Review the proposed development plans for the former CDE facility property to assess the ability to replace the pipeline in the future once the site has been developed.

### **Alternative WL-3: Water Line Replacement in New Easement**

Total Present Value	\$7,500,000 to \$8,500,000
Construction Time Frame	1 year

This alternative consists of relocating the existing water line to a new easement that does not cross the former CDE facility property. Alternative WL-3 would entail constructing a similarly

sized, new pipeline in the public right-of-way (ROW). The new pipeline route would need to be determined during the RD; a proposed route was developed by New Jersey American Water (NJAW) for evaluation purposes. Modifications to the existing distribution system would be done as necessary to accommodate the changes to the system configuration. Design and construction of the new pipeline would be done by NJAW with oversight by EPA.

This alternative would require addressing the following elements:

- Negotiations with the Borough of South Plainfield regarding construction of the pipeline in the public ROW.
- Negotiations with the owner of the railroad line (Conrail) regarding a jack and bore under their tracks at two locations.
- Evaluation to establish compliance with regulatory requirements for construction of the pipeline under Bound Brook.
- Modifications to the existing pipeline system to accommodate the proposed changes in the pipeline configuration.
- Abandoning the existing pipeline in place by disconnecting the pipeline from the water distribution system at both ends. The existing pipeline would be grouted closed at both ends.

### **Detailed Analysis of Alternatives**

During detailed analysis, the alternatives for the different site components will be evaluated against the nine evaluation criteria set forth in the NCP that have been developed to address CERCLA requirements for selecting among remedial alternatives. The evaluation criteria are as follows:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

Results of this analysis, which is underway, will be described in detail in the FS report.

### **TABLES**

Table 1 - Summary of Estimated Human Health Cancer Risks and non-Cancer Hazards

Table 2 - Summary of Ecological Risks for Sediment and Floodplain Soil

FIGURES

Figure 1 - OU4 Bound Brook Regional Location Map

Figure 2 - Location of the CDE Site OU4 Study Area

Figure 3 - Prominent Site Features in OU4 Bound Brook Study Area

Figure 4 - Operable Units (OU2, OU3, and OU4) of the CDE Superfund Site

Figure 5 - Exposure Units for OU4 Risk Assessment

Figure 6 – Low Resolution Core Aroclor 1254 Concentrations

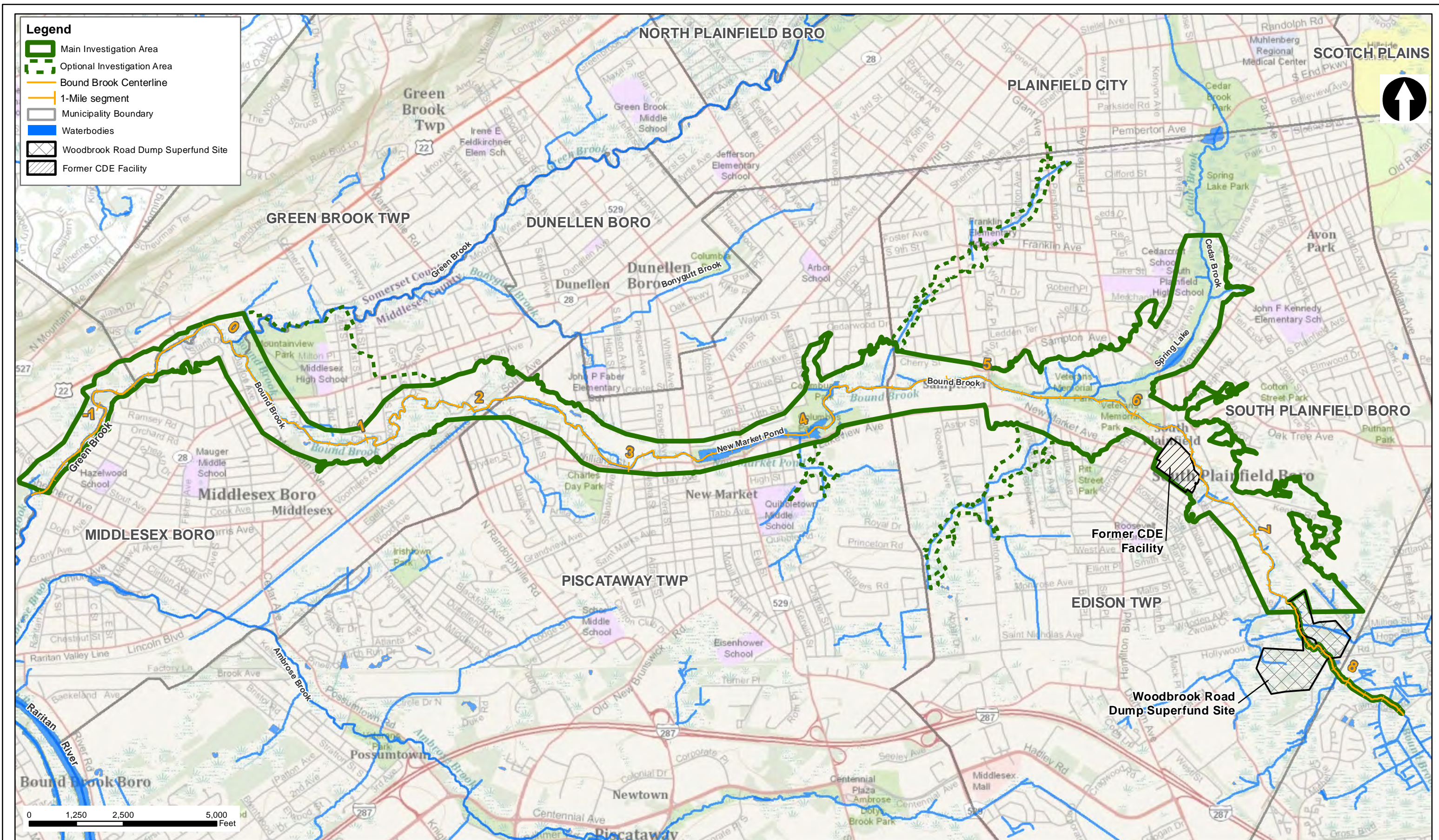
Figure 7 – Flood Plain Soil Aroclor 1254 Concentrations

Figure 8 – Feasibility Study Reaches

Figure 9 – Conceptual Flood Plain Soil Capping Areas

Figure 10 – Conceptual Bound Brook Reactive Cap Alignment

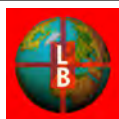
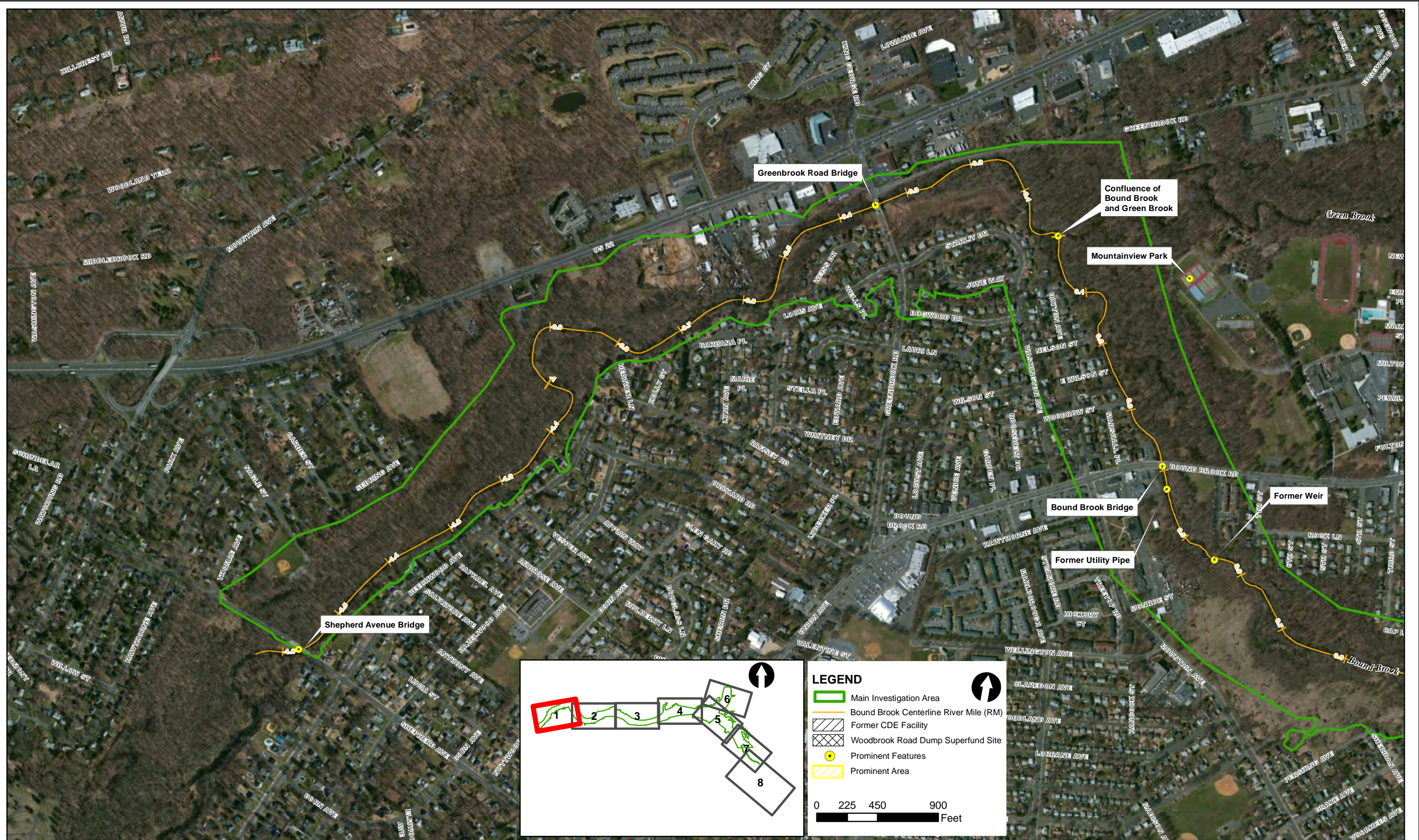




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Superfund Site  
South Plainfield, New Jersey

**OU4 Bound Brook Study Area**  
Bound Brook OU4 RI/FS

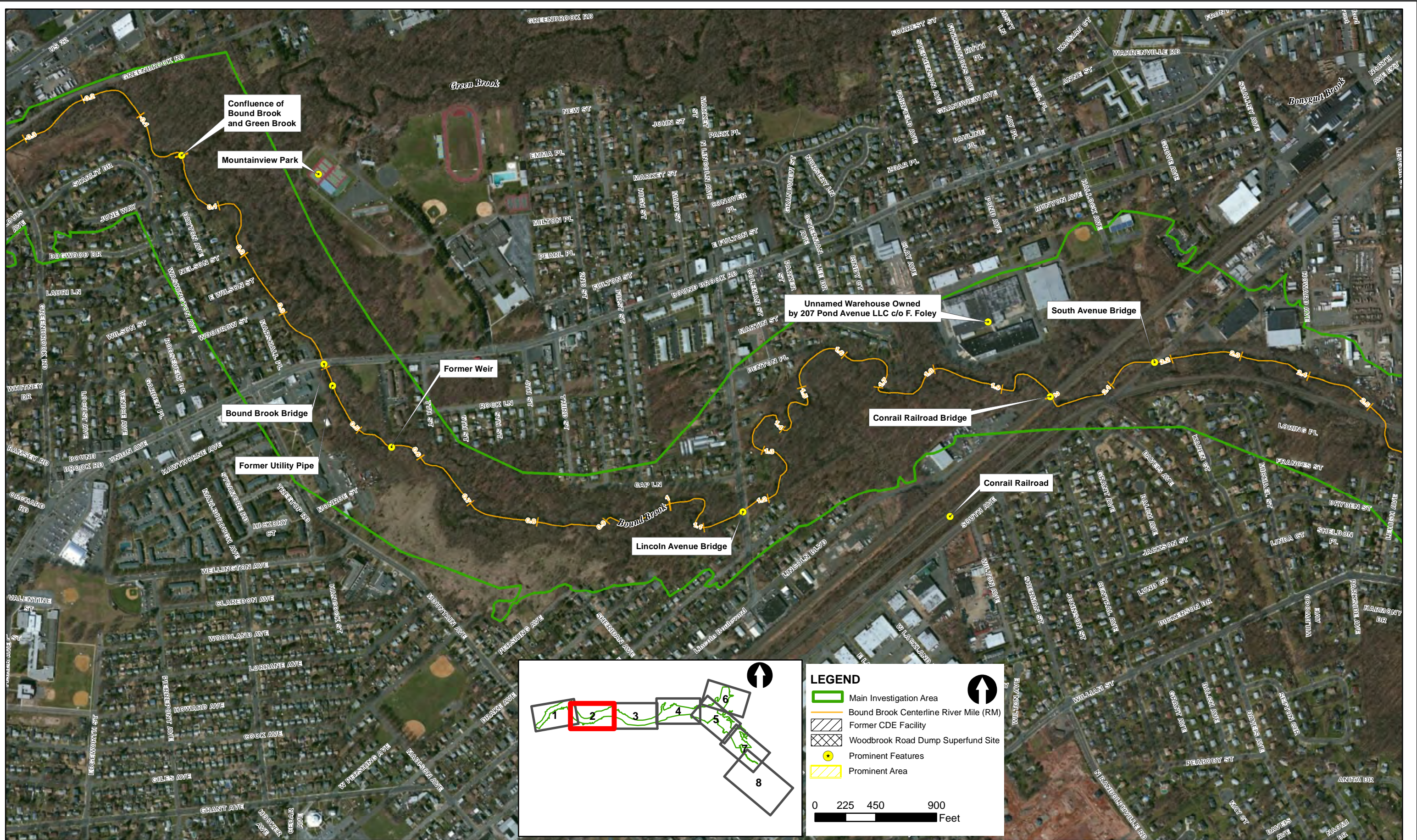
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Prominent Site Features in OU4 Bound Brook Study Area  
Bound Brook OU4 R/FS

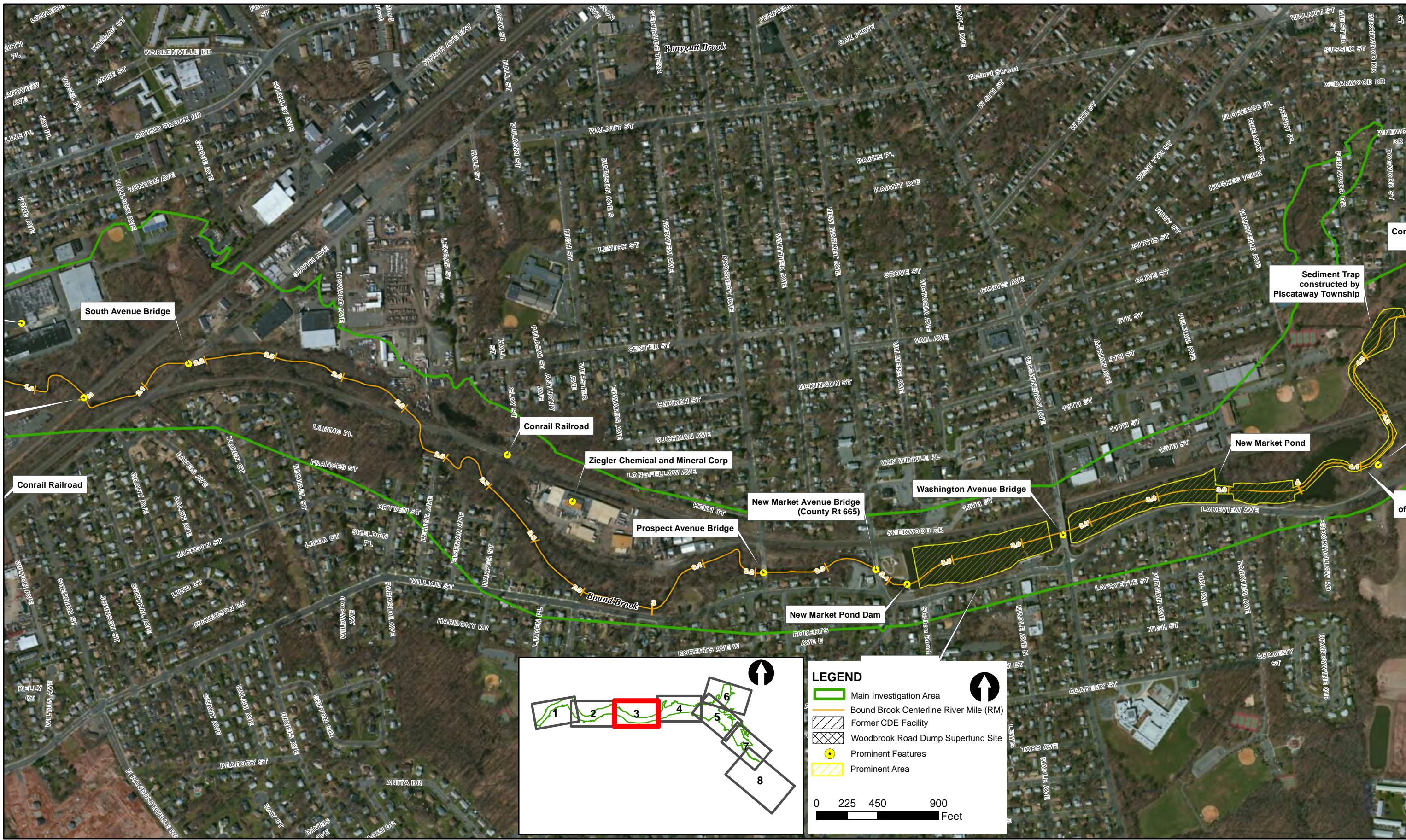
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**Prominent Site Features in OU4 Bound Brook Study Area**  
Bound Brook OU4 R/FS

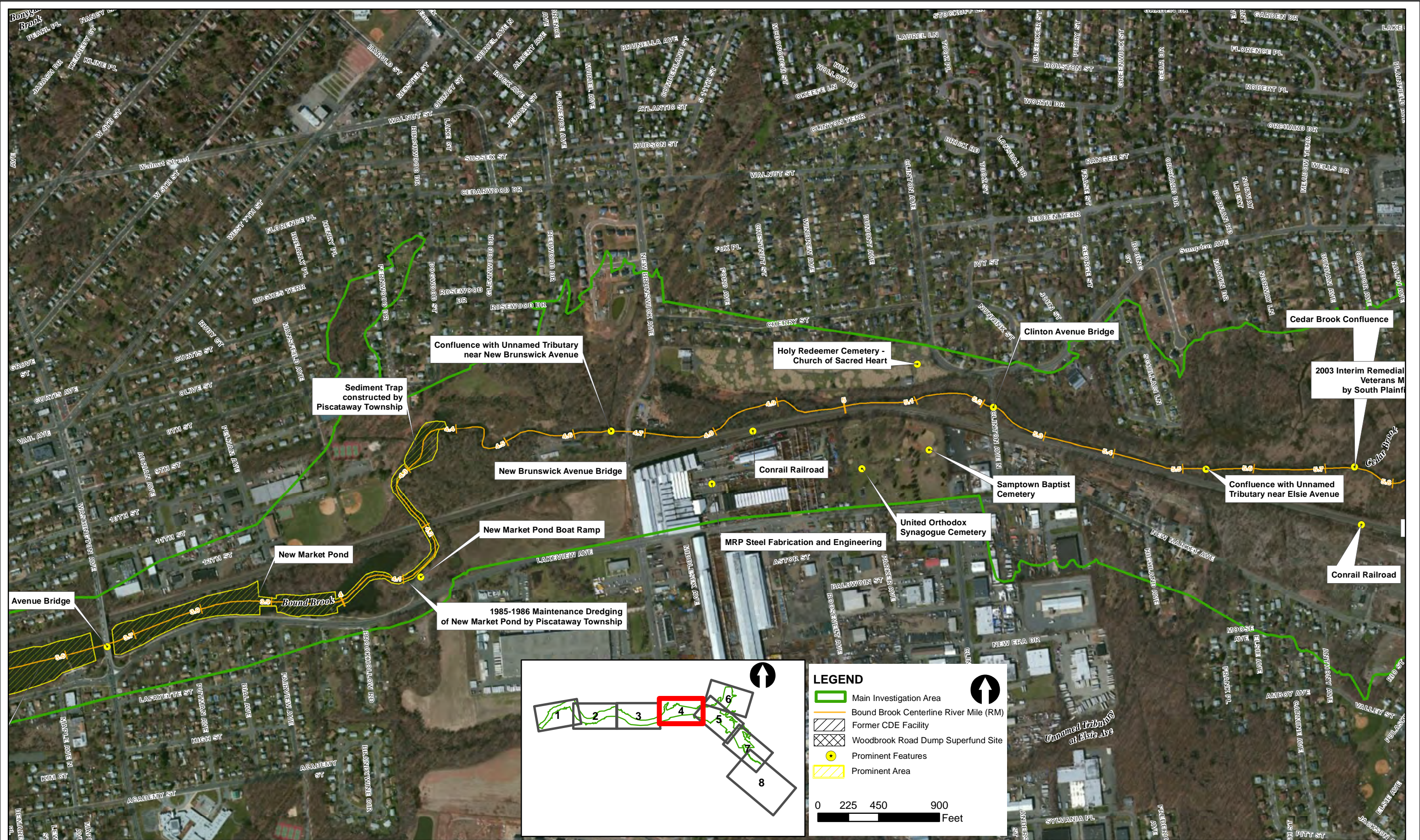
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Prominent Site Features in OU4 Bound Brook Study Area  
Bound Brook OU4 R/FS

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**Prominent Site Features in OU4 Bound Brook Study Area**  
Bound Brook OU4 R/FS

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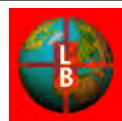
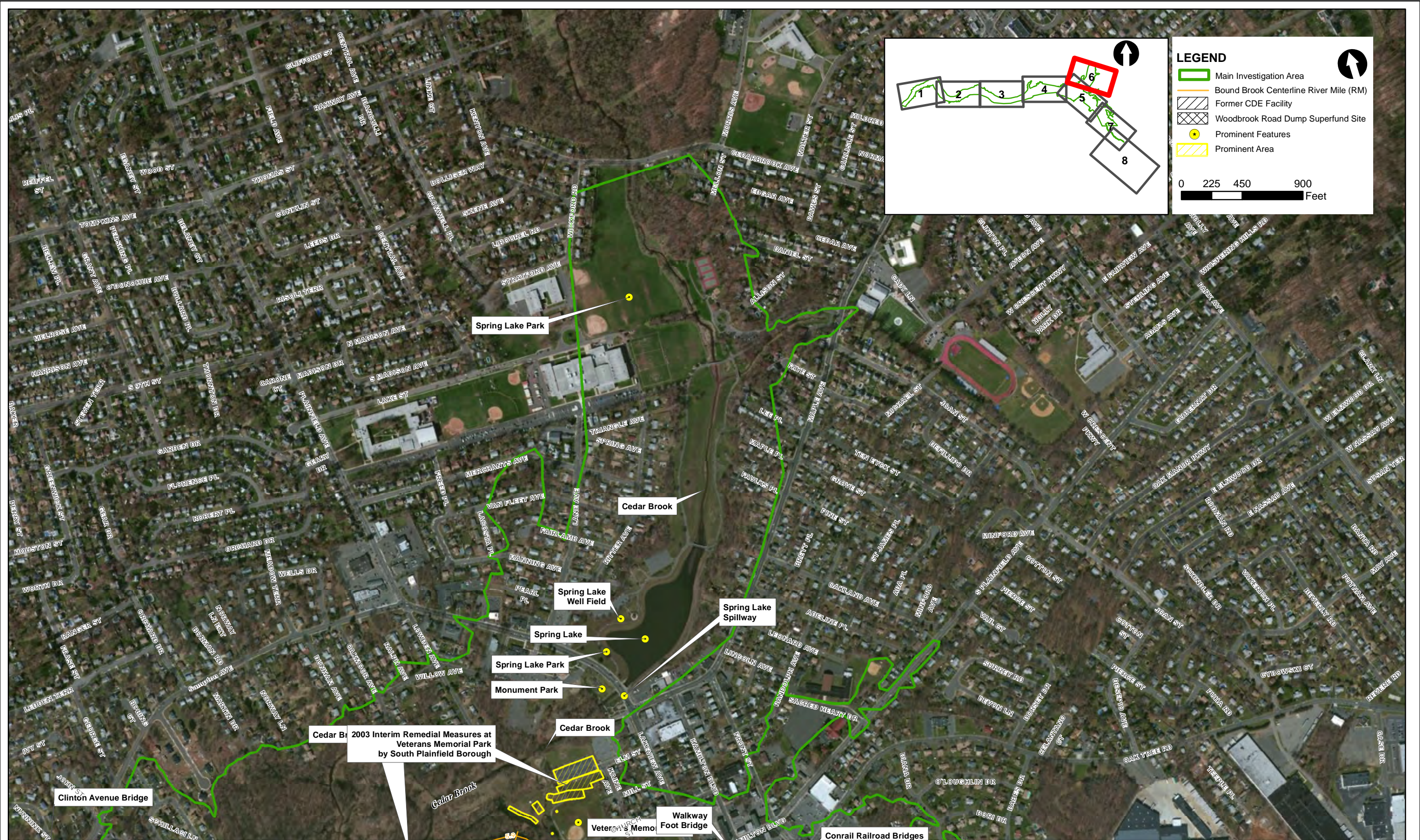


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**Prominent Site Features in OU4 Bound Brook Study Area**  
Bound Brook OU4 R/FS

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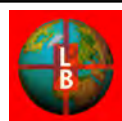
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South Plainfield, New Jersey

Prominent Site Features in OU4 Bound Brook Study Area  
Bound Brook OU4 R/FS

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Figure 3  
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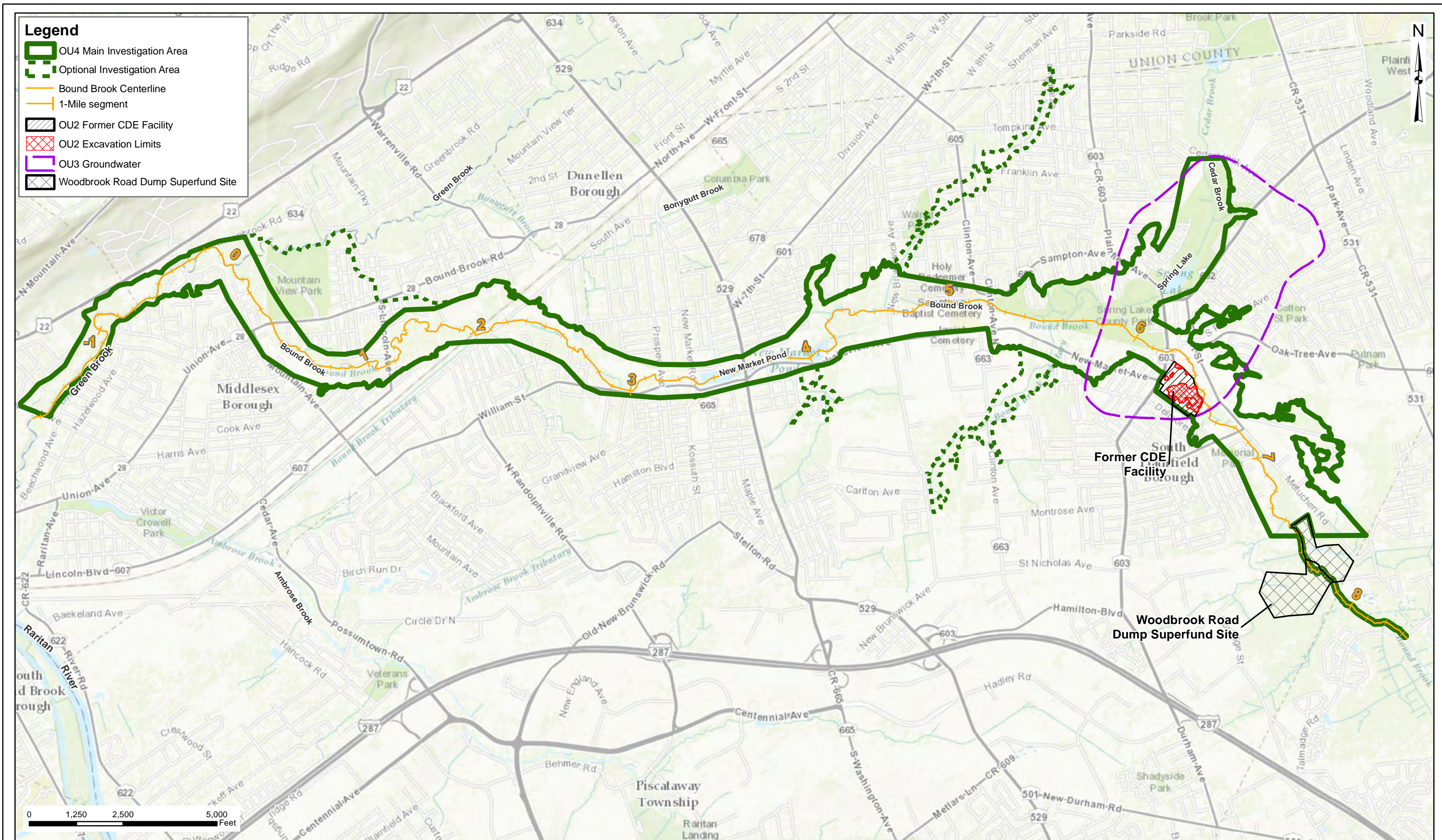


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Prominent Site Features in OU4 Bound Brook Study Area  
Bound Brook OU4 R/FS

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Figure 3  
Sheet 7 of 8



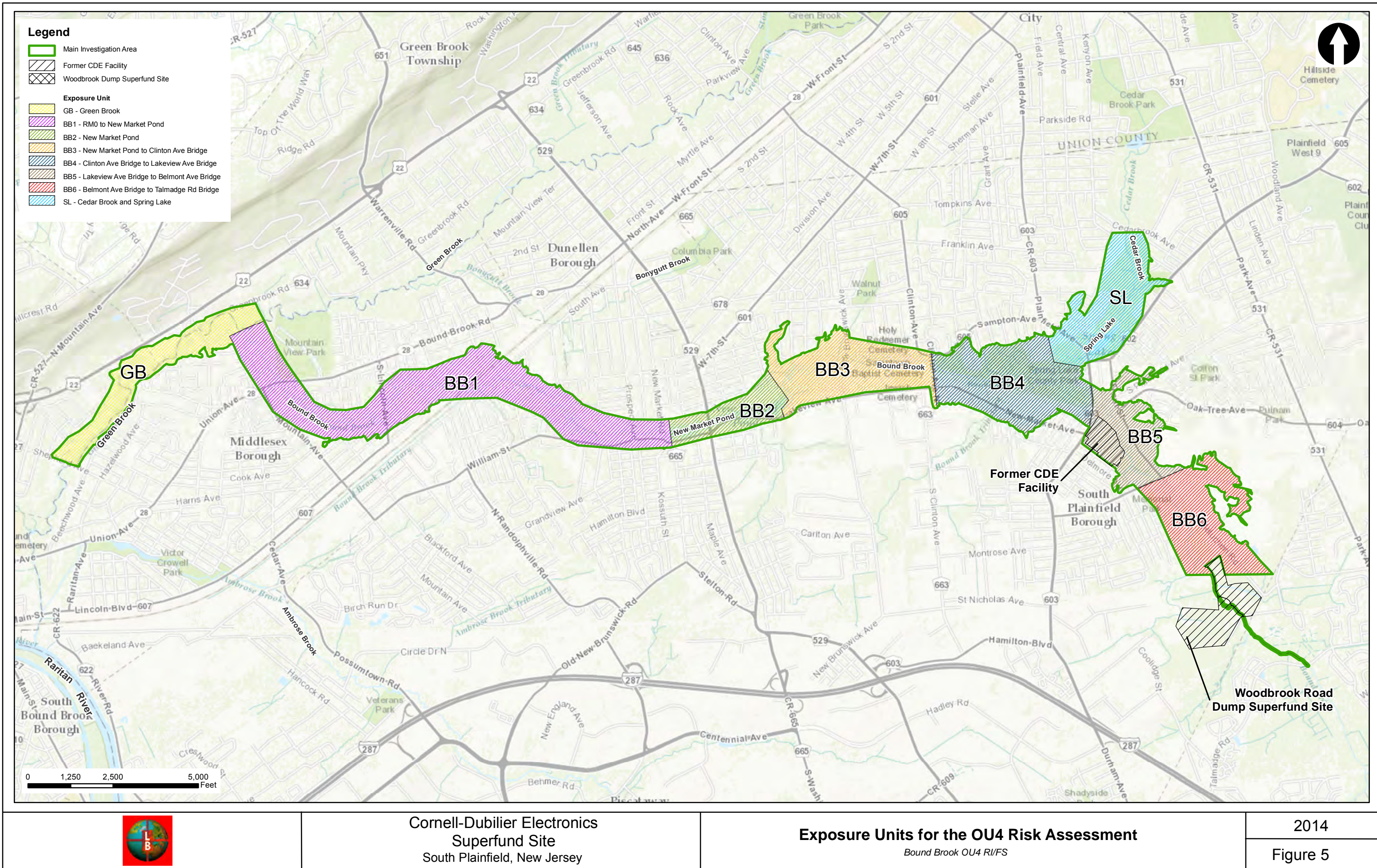


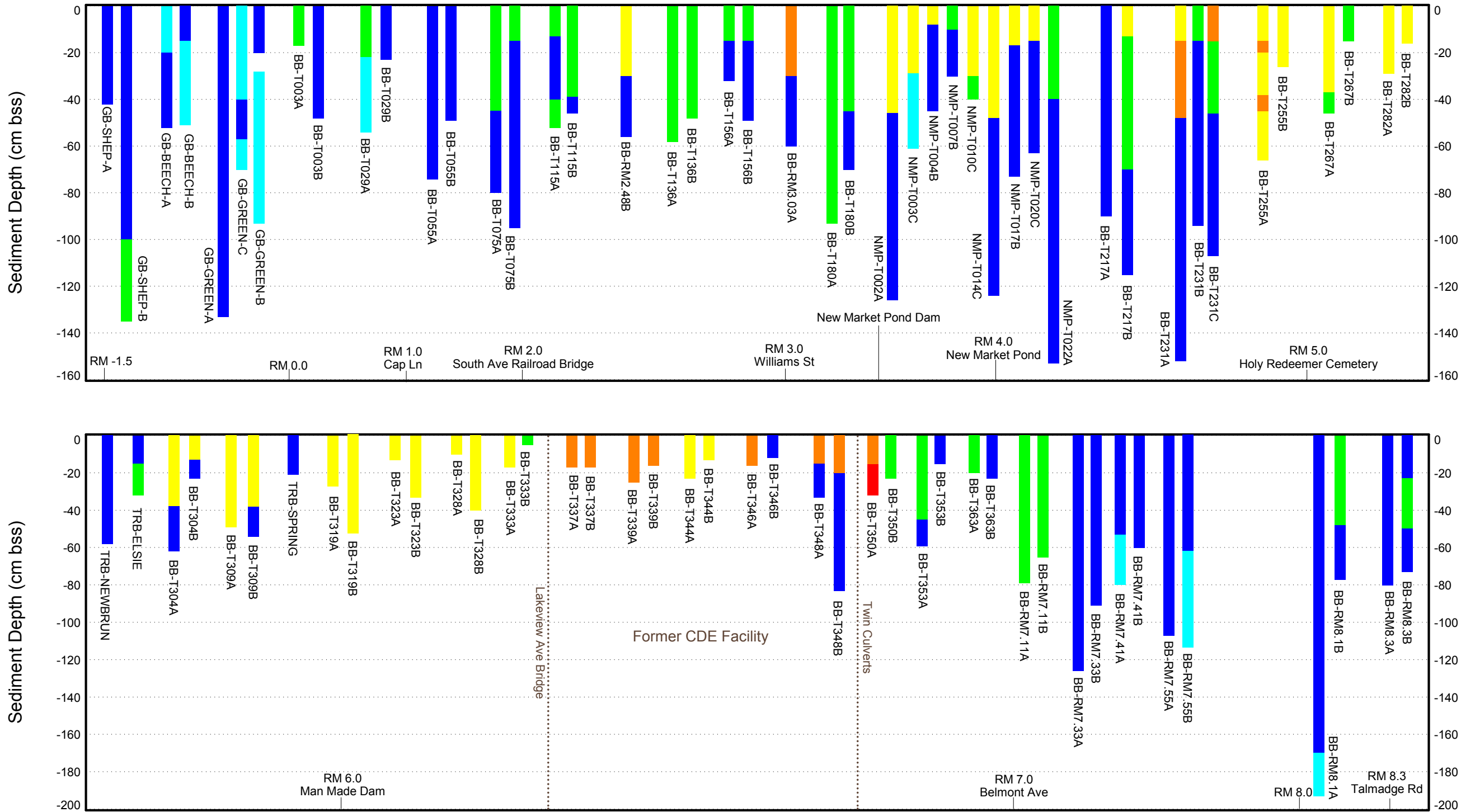
Cornell-Dubilier Electronics  
Superfund Site  
South Plainfield, New Jersey

**Operable Units (OU2, OU3, and OU4)**  
**of the Cornell-Dubilier Electronics Superfund Site**  
*Bound Brook OU4 RI/FS*

2014

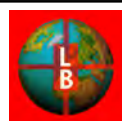
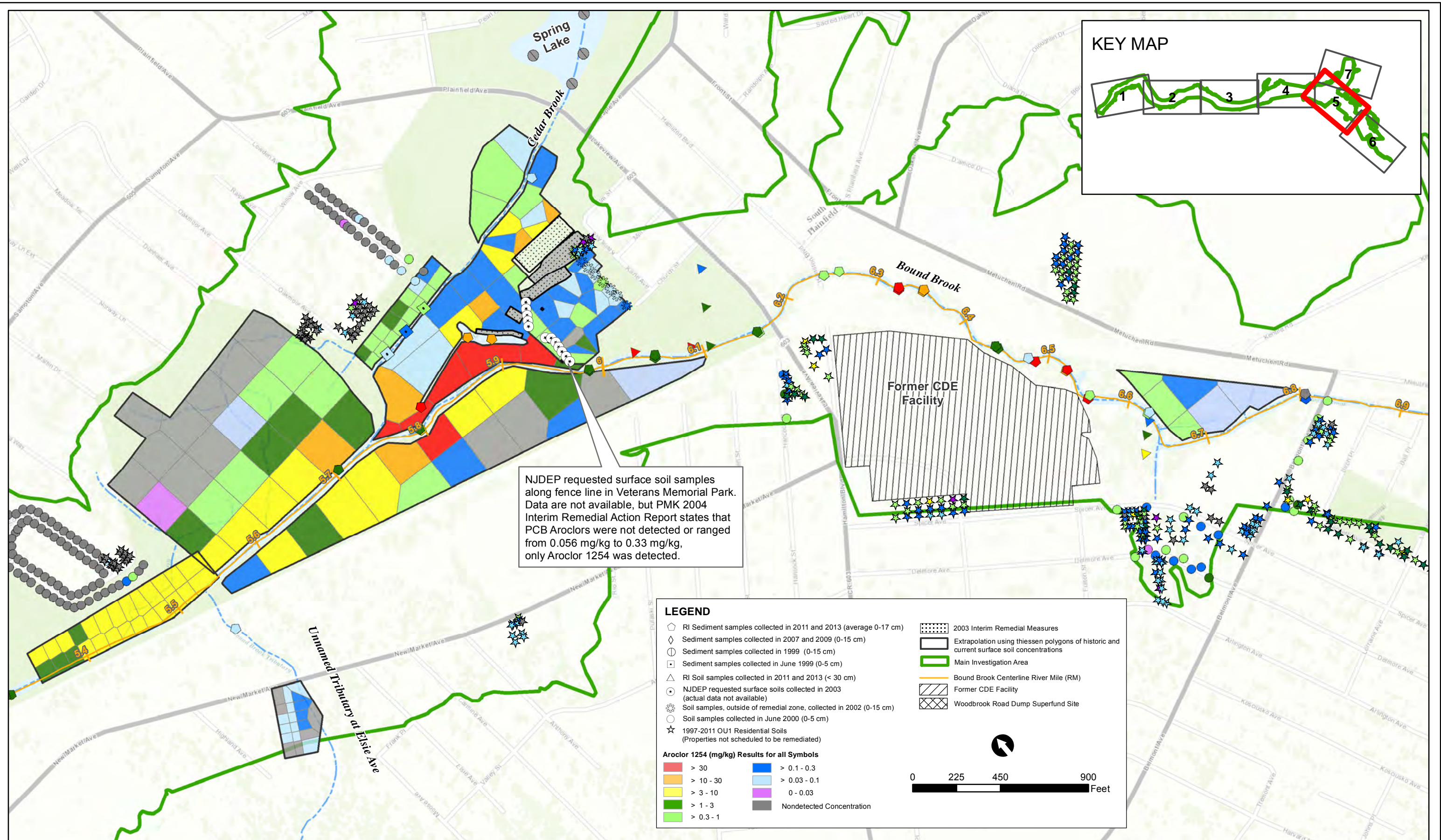
Figure 4





Notes:

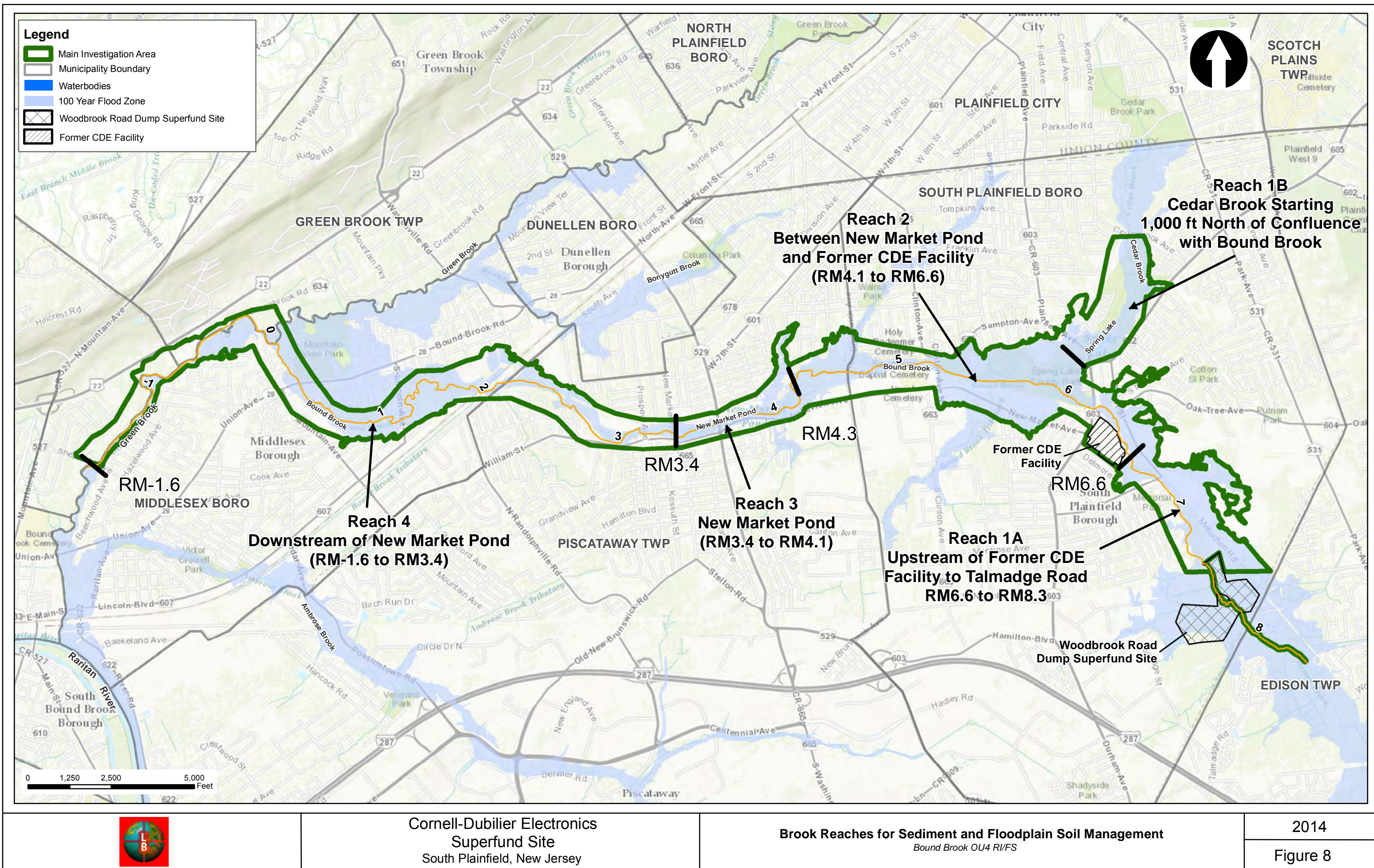
1. Non-detected concentrations are incorporated into the presentation as equal to their method detection limit.
2. Rejected concentrations are omitted in the presentation and will be projected as a break in the depth profile.
3. Cores labeled with an A are located at the South Bank. Cores labeled with a B are located at the North Bank.
4. Duplicate samples have been omitted from the presentation.
5. For transect BB-T231, A-core is located on the right bank looking upstream, B-core in the middle of the channel, and the C-core on the left bank looking upstream. For transect GB-GREEN, the A-core and B-core were initially collected equally spaced across the brook. The C-core was subsequently collected from the middle of the channel to further characterize the transect. In New Market Pond, sediment cores were co-located with the 2010 sediment probing points. Core designations correspond to the sediment probing sample identification letter, where the A-probing location was on the right bank looking upstream, the B-probing location was in the middle of the pond, and the C-probing location was on the left bank looking upstream.

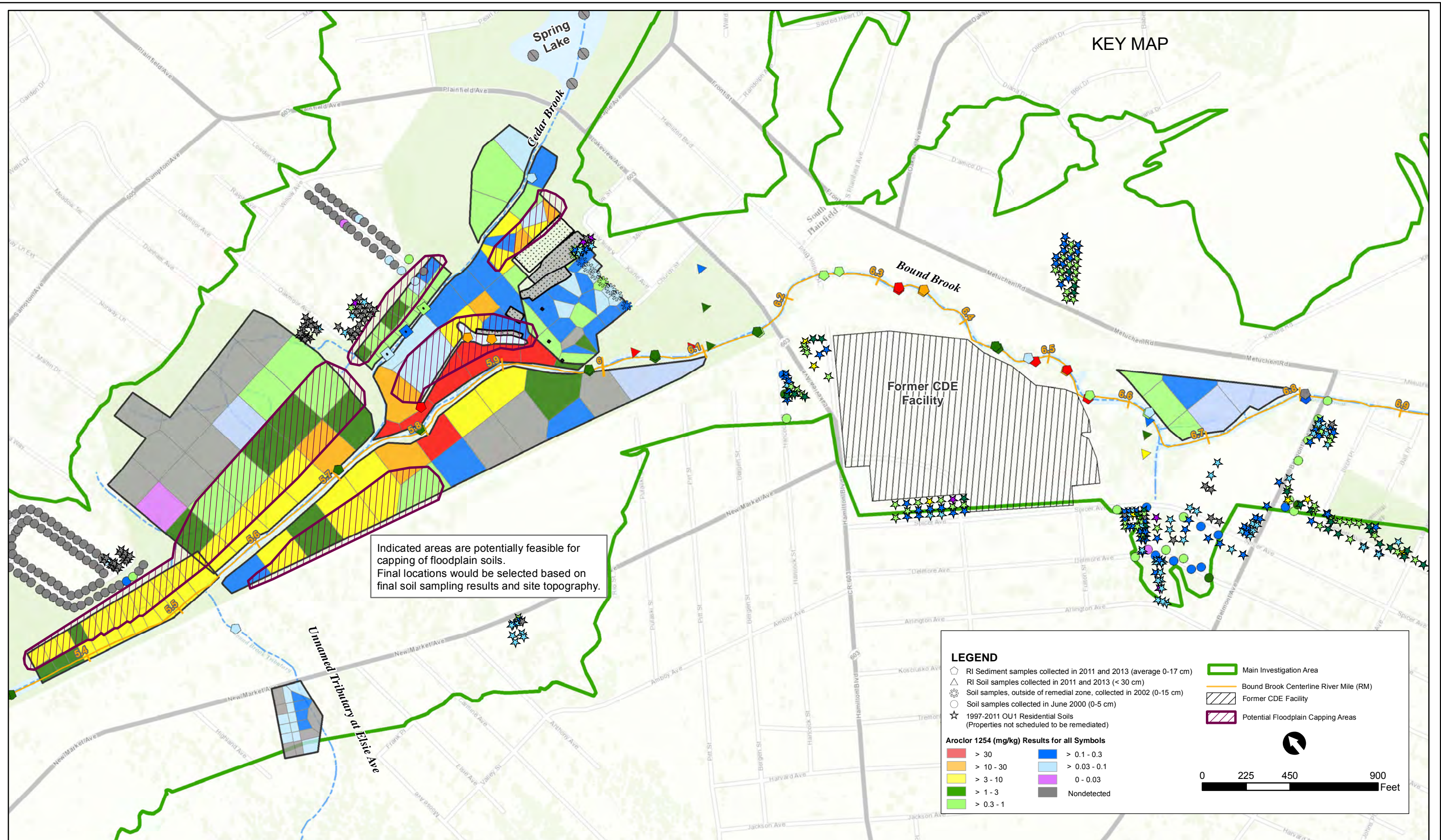


Cornell-Dubilier Electronics  
Superfund Site  
South Plainfield, New Jersey

Distribution of Aroclor 1254 Concentrations  
in and near OU4 Study Area  
Bound Brook OU4 RI/FS

2014  
Figure 7





Cornell-Dubilier Electronics  
Superfund Site  
South Plainfield, New Jersey

## Potential Floodplain Capping Areas

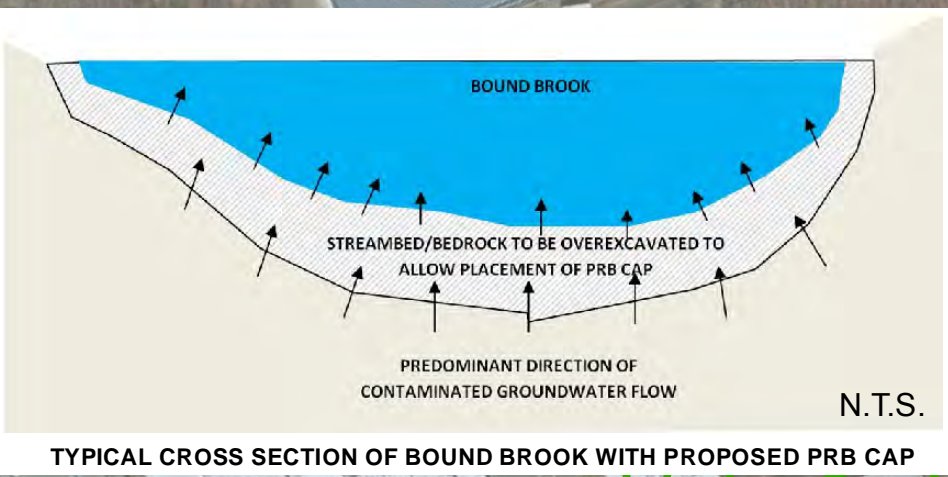
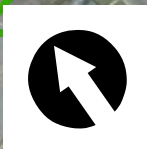
Bound Brook OU4 RI/FS

2014

Figure 9

**Legend**

- Main Investigation Area
- Bound Brook Centerline River Mile (RM)
- Former CDE Facility
- Proposed PRB Cap



Cornell-Dubilier Electronics  
Superfund Site  
South Plainfield, New Jersey

**Alternative GW-5: Reactive Cap**  
Bound Brook OU4 RI/FS

2014  
Figure 10

Table 1: Summary of Estimated Human Health Cancer Risks and Non-cancer Hazards - Reasonable Maximum Exposure  
Cornell-Dubilier Electronics Superfund Site: OU4 Bound Brook

Exposure Pathway	EU GB		EU BB1		EU BB2		EU BB3		EU BB4		EU BB5		EU BB6		EU SL	
	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
Recreationist/Sportsman - Adult																
Surface water	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01
Sediment - surface sediment	3E-06	2E-02	1E-03	4E-01	2E-03	2E-01	4E-03	4E-01	2E-03	5E-01	1E-03	2E+00	8E-04	6E-02	3E-05	2E-02
Floodplain soil - surface soil	2E-06	4E-02	3E-06	5E-02	2E-06	4E-02	7E-06	2E-01	9E-06	2E-01	4E-05	8E-01	2E-05	1E+00	not applicable	
Total per Receptor and EU RAGS Part D table reference	1E-05	3E-01	1E-03	7E-01	2E-03	6E-01	4E-03	9E-01	2E-03	1E+00	1E-03	3E+00	8E-04	1E+00	3E-05	3E-01
Chemical contributor			10.1BB1 Benzidine		10.1BB2 Benzidine		10.1BB3 Benzidine		10.1BB4 Benzidine		Benzidine 10.1BB5		10.1 BB6 Benzidine			
Total PCBs																
Recreationist/Sportsman - Adolescent																
Surface water	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01
Sediment - surface sediment	9E-07	5E-02	3E-04	7E-01	3E-04	4E-01	9E-04	6E-01	4E-04	7E-01	2E-04	2E+00	2E-04	1E-01	6E-06	5E-02
Floodplain soil - surface soil	2E-06	1E-01	2E-06	1E-01	2E-06	1E-01	6E-06	7E-01	8E-06	7E-01	4E-05	2E+00	2E-05	3E+00	not applicable	
Total per Receptor and EU RAGS Part D table reference	5E-06	5E-01	3E-04	1E+00	3E-04	8E-01	9E-04	2E+00	4E-04	2E+00	3E-04	5E+00	2E-04	3E+00	8E-06	4E-01
Chemical contributor			10.2BB1 Benzidine		10.2BB2 Benzidine		10.2BB3 Benzidine	none > 1	10.2BB4 Benzidine	none > 1	Benzidine 10.2BB5		Benzidine 10.2BB6			
Total PCBs																
Angler - Adult (Predatory Fish Fillet)																
Surface water	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01
Sediment - surface sediment	3E-06	2E-02	1E-03	4E-01	2E-03	2E-01	4E-03	4E-01	2E-03	5E-01	1E-03	2E+00	8E-04	6E-02	3E-05	2E-02
Floodplain soil - surface soil	2E-06	4E-02	3E-06	5E-02	2E-06	4E-02	7E-06	2E-01	9E-06	2E-01	4E-05	8E-01	2E-05	1E+00	not applicable	
Predatory fish	4E-04	2E+01	4E-04	2E+01	6E-04	3E+01	1E-03	5E+01	1E-03	5E+01	4E-03	1E+02	1E-04	5E+00	3E-04	1E+01
Total per Receptor and EU RAGS Part D table reference	4E-04	2E+01	2E-03	2E+01	2E-03	3E+01	5E-03	5E+01	3E-03	5E+01	5E-03	1E+02	9E-04	6E+00	3E-04	1E+01
Chemical contributor	10.3 GB Total PCBs		10.3 BB1 Total PCBs		10.3 BB2 Total PCBs TCDD TEQ (PCBs)		10.3 BB3 Total PCBs TCDD TEQ (PCBs)		10.3 BB4 Total PCBs TCDD TEQ (PCBs)		10.3 BB5 Total PCBs TCDD TEQ (PCBs)		10.3BB6 Total PCBs		10.3SL Total PCBs	
Angler - Adult (Bottom-Feeding Fish Fillet)																
Surface water	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01
Sediment - surface sediment	3E-06	2E-02	1E-03	4E-01	2E-03	2E-01	4E-03	4E-01	2E-03	5E-01	1E-03	2E+00	8E-04	6E-02	3E-05	2E-02
Floodplain soil - surface soil	2E-06	4E-02	3E-06	5E-02	2E-06	4E-02	7E-06	2E-01	9E-06	2E-01	4E-05	8E-01	2E-05	1E+00	not applicable	
Bottom-feeding fish	5E-03	3E+02	5E-03	3E+02	8E-03	3E+02	3E-03	1E+02	3E-03	1E+02	2E-02	6E+02	2E-03	1E+02	3E-03	1E+02
Total per Receptor and EU RAGS Part D table reference	5E-03	3E+02	7E-03	3E+02	9E-03	3E+02	7E-03	1E+02	4E-03	1E+02	2E-02	6E+02	3E-03	1E+02	3E-03	1E+02
Chemical contributor	10.3 GB Total PCBs		10.3 BB1 Total PCBs		10.3 BB2 Heptachlor epoxide Total PCBs TCDD TEQ (PCBs)		10.3 BB3 Total PCBs TCDD TEQ (PCBs)		10.3 BB4 Total PCBs TCDD TEQ (PCBs)		10.3 BB5 Total PCBs TCDD TEQ (PCBs)		10.3BB6 Total PCBs TCDD TEQ (PCBs)		10.3SL Total PCBs TCDD TEQ (PCBs)	
Angler - Adult (Asiatic Clams)																
Surface water	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01
Sediment - surface sediment	3E-06	2E-02	1E-03	4E-01	2E-03	2E-01	4E-03	4E-01	2E-03	5E-01	1E-03	2E+00	8E-04	6E-02	3E-05	2E-02
Floodplain soil - surface soil	2E-06	4E-02	3E-06	5E-02	2E-06	4E-02	7E-06	2E-01	9E-06	2E-01	4E-05	8E-01	2E-05	1E+00	not applicable	
Asiatic clams	1E-04	4E+00	1E-04	4E+00	1E-04	4E+00	1E-04	4E+00	1E-04	4E+00	1E-04	4E+00	8E-06	3E-01	1E-04	4E+00
Total per Receptor and EU RAGS Part D table reference	1E-04	4E+00	1E-03	5E+00	2E-03	4E+00	4E-03	5E+00	2E-03	5E+00	1E-03	7E+00	8E-04	2E+00	1E-04	4E+00
Chemical contributor	10.3 GB Total PCBs		10.3 BB1 Total PCBs		10.3 BB2 Total PCBs		10.3 BB3 Total PCBs		10.3 BB4 Total PCBs		10.3 BB5 Total PCBs		10.3BB6 Total PCBs		10.3SL Total PCBs	
Angler - Adult (Crayfish)																
Surface water	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01	5E-06	3E-01
Sediment - surface sediment	3E-06	2E-02	1E-03	4E-01	2E-03	2E-01	4E-03	4E-01	2E-03	5E-01	1E-03	2E+00	8E-04	6E-02	3E-05	2E-02
Floodplain soil - surface soil	2E-06	4E-02	3E-06	5E-02	2E-06	4E-02	7E-06	2E-01	9E-06	2E-01	4E-05	8E-01	2E-05	1E+00	not applicable	
Crayfish	5E-05	2E+00	5E-05	2E+00	5E-05	2E+00	5E-05	2E+00	5E-05	2E+00	5E-05	2E+00	5E-05	3E+00	5E-05	2E+00
Total per Receptor and EU RAGS Part D table reference	6E-05	2E+00	1E-03	3E+00	2E-03	3E+00	4E-03	3E+00	2E-03	3E+00	1E-03	5E+00	9E-04	4E+00	9E-05	2E+00
Chemical contributor	10.3 GB Total PCBs		10.3 BB1 Total PCBs		10.3 BB2 Total PCBs		10.3 BB3 Total PCBs		10.3 BB4 Total PCBs		10.3 BB5 Total PCBs		10.3BB6 Total PCBs		10.3SL Total PCBs	
Angler - Adolescent (Predatory Fish Fillet)																
Surface water	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01
Sediment - surface sediment	9E-07	5E-02	3E-04	7E-01	3E-04	4E-01	9E-04	6E-01	4E-04	7E-01	2E-04	2E+00	2E-04	1E-01	6E-06	5E-02
Floodplain soil - surface soil	2E-06	1E-01	2E-06	1E-01	2E-06	1E-01	6E-06	7E-01	8E-06	7E-01	4E-05	2E+00	2E-05	3E+00	not applicable	
Predatory fish	1E-04	2E+01	1E-04	2E+01	2E-04	2E+01	4E-04	5E+01	4E-04	5E+01	1E-03	1E+02	4E-05	5E+00	1E-04	1E+01
Total per Receptor and EU RAGS Part D table reference	1E-04	2E+01	4E-04	2E+01	6E-04	2E+01	1E-03	5E+01	8E-04	5E+01	2E-03	1E+02	2E-04	8E+00	1E-04	1E+01
Chemical contributor	10.4 GB Total PCBs		none > 1E-04	10.4 BB1 Total PCBs	none > 1E-04	10.4 BB2 Total PCBs TCDD TEQ	10.4 BB3 Total PCBs TCDD TEQ (PCBs)		10.4 BB4 Total PCBs TCDD TEQ (PCBs)		10.4 BB5 Total PCBs TCDD TEQ (PCBs)		10.4BB6 Total PCBs		10.4 SL Total PCBs	
Angler - Adolescent (Bottom-Feeding Fish Fillet)																
Surface water	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01
Sediment - surface sediment	9E-07	5E-02	3E-04	7E-01	3E-04	4E-01	9E-04	6E-01	4E-04	7E-01	2E-04	2E+00	2E-04	1E-01	6E-06	5E-02
Floodplain soil - surface soil	2E-06	1E-01	2E-06	1E-01	2E-06	1E-01	6E-06	7E-01	8E-06	7E-01	4E-05	2E+00	2E-05	3E+00	not applicable	
Bottom-feeding fish	2E-03	3E+02	2E-03	3E+02	3E-03	3E+02	1E-03	1E+02	1E-03	1E+02	7E-03	6E+02	7E-04	1E+02	1E-03	1E+02
Total per Receptor and EU RAGS Part D table reference	2E-03	3E+02	2E-03	3E+02	3E-03	3E+02	2E-03	1E+02	1E-03	1E+02	7E-03	6E+02	9E-04	1E+02	1E-03	1E+02
Chemical contributor	10.4 GB Total PCBs		10.4 BB1 Total PCBs		10.4 BB2 Heptachlor epoxide Total PCBs TCDD TEQ (PCBs)		10.4 BB3 Total PCBs TCDD TEQ (PCBs)		10.4 BB4 Total PCBs TCDD TEQ (PCBs)		10.4 BB5 Total PCBs TCDD TEQ (PCBs)		10.4 BB6 Total PCBs TCDD TEQ (PCBs)		10.4 SL Total PCBs TCDD TEQ (PCBs)	
Angler - Adolescent (Asiatic Clams)																
Surface water	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01
Sediment - surface sediment	9E-07	5E-02	3E-04	7E-01	3E-04	4E-01	9E-04	6E-01	4E-04	7E-01	2E-04	2E+00	2E-04	1E-01	6E-06	5E-02
Floodplain soil - surface soil	2E-06	1E-01	2E-06	1E-01	2E-06	1E-01	6E-06	7E-01	8E-06	7E-01	4E-05	2E+00	2E-05	3E+00	not applicable	
Asiatic clams	4E-05	4E+00	4E-05	4E+00	4E-05	4E+00	4E-05	4E+00	4E-05	4E+00	4E-05	4E+00	3E-06	2E-01	4E-05	4E+00
Total per Receptor and EU RAGS Part D table reference	4E-05	4E+00	3E-04	5E+00	4E-04	4E+00	9E-04	5E+00	4E-04	5E+00	3E-04	9E+00	2E-04	4E+00	4E-05	4E+00
Chemical contributor	10.4 GB Total PCBs		none > 1E-04	10.4 BB1 Total PCBs	10.4 BB2 Total PCBs		10.4 BB3 Total PCBs		10.4 BB4 Total PCBs		10.4 BB5 Total PCBs		10.4BB6 none		10.4 SL Total PCBs	
Angler - Adolescent (Crayfish)																
Surface water	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01	2E-06	3E-01
Sediment - surface sediment	9E-07	5E-02	3E-04	7E-01	3E-04	4E-01	9E-04	6E-01	4E-04	7E-01	2E-04	2E+00	2E-04	1E-01	6E-06	5E-02
Floodplain soil - surface soil	2E-06	1E-01	2E-06	1E-01	2E-06	1E-01	6E-06	7E-01	8E-06	7E-01	4E-05	2E+00	2E-05	3E+00	not applicable	

Table 1: Summary of Estimated Human Health Cancer Risks and Non-cancer Hazards - Reasonable Maximum Exposure  
Cornell-Dubilier Electronics Superfund Site: OU4 Bound Brook

Exposure Pathway	EU GB		EU BB1		EU BB2		EU BB3		EU BB4		EU BB5		EU BB6		EU SL	
	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard	Cancer Risk	Noncancer Hazard
Crayfish	2E-05	2E+00	2E-05	2E+00	2E-05	2E+00	2E-05	2E+00	2E-05	2E+00	2E-05	2E+00	2E-05	3E+00	2E-05	2E+00
Total per Receptor and EU RAGS Part D table reference	2E-05	2E+00	3E-04	3E+00	4E-04	3E+00	9E-04	4E+00	4E-04	4E+00	3E-04	7E+00	2E-04	6E+00	3E-05	2E+00
Chemical contributor		10.4 GB Total PCBs	none > 1E-04	10.4 BB1 Total PCBs		10.4 BB2 Total PCBs		10.4 BB3 Total PCBs		10.4 BB4 Total PCBs		10.4 BB5 Total PCBs		10.4 BB6 Total PCBs		10.4 SL Total PCBs
Angler - Child (Predatory Fish Fillet)																
Predatory fish	1E-04	3E+01	1E-04	3E+01	2E-04	4E+01	4E-04	8E+01	4E-04	8E+01	1E-03	2E+02	4E-05	8E+00	9E-05	2E+01
Total per Receptor and EU RAGS Part D table reference		same as above 10.5 GB		same as above 10.5 BB1		same as above 10.5 BB2		same as above 10.5 BB3		same as above 10.5 BB4		same as above 10.5 BB5 Heptachlor epoxide		same as above 10.5 BB6		same as above 10.5 SL
Chemical contributor		Total PCBs		Total PCBs		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs
Angler - Child (Bottom-Feeding Fish Fillet)																
Bottom-feeding fish	2E-03	4E+02	2E-03	4E+02	2E-03	4E+02	8E-04	2E+02	8E-04	2E+02	6E-03	9E+02	6E-04	2E+02	8E-04	2E+02
Total per Receptor and EU RAGS Part D table reference		same as above 10.5 GB		same as above 10.5 BB1		same as above 10.5 BB2 Heptachlor epoxide		same as above 10.5 BB3 Heptachlor epoxide		same as above 10.5 BB4 Heptachlor epoxide		same as above 10.5 BB5		same as above 10.5 BB6		same as above 10.5 SL
Chemical contributor		Total PCBs		Total PCBs		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)
Angler - Child (Asiatic clams)																
Asiatic clams	3E-05	6E+00	3E-05	6E+00	3E-05	6E+00	3E-05	6E+00	3E-05	6E+00	3E-05	6E+00	2E-06	4E-01	3E-05	6E+00
Total per Receptor and EU RAGS Part D table reference		same as above 10.5 GB		same as above 10.5 BB1		same as above 10.5 BB2		same as above 10.5 BB3		same as above 10.5 BB4		same as above 10.5 BB5		same as above		same as above 10.5 SL
Chemical contributor		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)		Total PCBs TCDD TEQ (PCBs)				Total PCBs TCDD TEQ (PCBs)
Angler - Child (Crayfish)																
Crayfish	2E-05	3E+00	2E-05	3E+00	2E-05	3E+00	2E-05	3E+00	2E-05	3E+00	2E-05	3E+00	2E-05	4E+00	2E-05	3E+00
Total per Receptor and EU RAGS Part D table reference		same as above 10.5 GB		same as above 10.5 BB1		same as above 10.5 BB2		same as above 10.5 BB3		same as above 10.5 BB4		same as above 10.5 BB5		same as above 10.5 BB6		same as above 10.5 SL
Chemical contributor		Total PCBs		Total PCBs		Total PCBs		Total PCBs		Total PCBs		Total PCBs		Total PCBs		Total PCBs
Outdoor Worker - Adult																
Surface water	2E-07	1E-01	2E-07	1E-01	2E-07	1E-01	2E-07	1E-01	2E-07	1E-01	2E-07	1E-01	2E-07	1E-01	2E-07	1E-01
Sediment - all sediment	2E-07	4E-02	6E-05	2E-01	7E-05	2E-01	2E-04	3E-01	8E-05	2E-01	5E-05	7E-01	4E-05	8E-02	1E-06	5E-02
Floodplain soil - all soil	2E-07	1E-01	4E-07	1E-01	3E-07	1E-01	1E-06	7E-01	1E-06	5E-01	3E-06	9E-01	2E-06	1E+00		not applicable
Total per Receptor and EU RAGS Part D table reference	6E-07	3E-01	6E-05	4E-01	7E-05	4E-01	2E-04	1E+00	8E-05	9E-01	5E-05	2E+00	4E-05	1E+00	1E-06	2E-01
Chemical contributor							10.6BB3 Benzidine					none > 1 Total PCBs				
Resident - Adult																
Floodplain soil - all soil	6E-05	3E-01	8E-05	3E-01	5E-05	3E-01	3E-04	2E+00	2E-04	2E+00	6E-04	4E+00	4E-04	7E+00		not applicable
Total per Receptor and EU RAGS Part D table reference		same as above		same as above		same as above		same as above none > 1E-04 none > 1		same as above none > 1E-04 10.7BB4		same as above 10.7BB5		same as above 10.7BB6		not applicable
Chemical contributor										Total PCBs		Dieldrin Total PCBs		Total PCBs		
Resident - Child																
Floodplain soil - all soil	5E-05	2E+00	7E-05	2E+00	4E-05	2E+00	2E-04	2E+01	2E-04	2E+01	4E-04	4E+01	3E-04	6E+01		not applicable
Total per Receptor and EU RAGS Part D table reference		same as above none > 1		same as above none > 1		same as above none > 1		same as above none > 1E-04 10.8BB3		same as above none > 1E-04 10.8BB4		same as above none > 1E-04 10.8BB5 Dieldrin		same as above 10.8BB6		not applicable
Chemical contributor								Total PCBs Antimony Iron Thallium		Total PCBs		Total PCBs		Total PCBs		
Commercial/Industrial Worker - Adult																
Floodplain soil - surface soil	1E-05	2E-01	1E-05	2E-01	1E-05	2E-01	3E-05	1E+00	4E-05	1E+00	1E-04	4E+00	8E-05	5E+00		not applicable
Total per Receptor and EU RAGS Part D table reference		same as above		same as above		same as above		same as above		same as above		same as above 10.9BB5		same as above 10.9BB6		not applicable
Chemical contributor												total PCBs		total PCBs		
Construction/Utility Worker - Adult																
Floodplain soil - all soil	4E-07	7E+00	5E-07	6E+00	4E-07	5E+00	1E-06	8E+00	1E-06	5E+00	4E-06	7E+00	2E-06	6E+00		not applicable
Total per Receptor and EU RAGS Part D table reference		same as above 10.10GB		same as above 10.10BB1		same as above 10.10BB2		same as above 10.10BB3		same as above 10.10BB4		same as above 10.10BB5		same as above 10.10BB6		not applicable
Chemical contributor		Manganese		Manganese		Manganese		Manganese		Manganese		Manganese		Manganese		

Notes

Cancer risks greater than 1E-04 and non-cancer hazards greater than 1E+00 are bolded and shaded.

Exposure Unit (EU) Abbreviations:

GB = Green Brook (RM -1.58 to 0)  
BB1 = Bound Brook (RM 0 to 3.43)  
BB2 = Bound Brook (RM 3.43 to 4.09)  
BB3 = Bound Brook (RM 4.09 to 5.22)  
BB4 = Bound Brook (RM 5.22 to RM 6.18)  
BB5 = Bound Brook (RM 6.18 to 6.82)  
BB6 = Bound Brook (RM 6.82 to RM 8.31)  
SL = Spring Lake

**Table 2-1: Summary Ecological Risks for Sediment - Benthic Invertebrates and Aquatic Life <sup>1</sup>**  
**Cornell-Dubilier Electronics Superfund Site: OU4 Bound Brook**

Receptor	Line of Evidence		Exposure Unit							
			EU BG	EU BB1	EU BB2	EU BB3	EU BB4	EU BB5	EU BB6	EU SL
Benthic Invertebrates	Comparison of surface sediment data to protective screening concentrations			Total PCBs	Total PCBs	Total PCBs	Total PCBs	Vinyl chloride Total PCBs	Total PCBs	
	Comparison of porewater data to protective screening concentrations <sup>2</sup>							cis-1,2-DCE Vinyl chloride Total PCBs		
	Comparison of tissue residue data to critical body residues	Asiatic clam	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs		Total PCBs
		Crayfish							Total PCBs	
	Sediment Toxicity		N/A	Toxic	Toxic	Toxic	N/A	Toxic	N/A	N/A
	PCB Bioaccumulation		N/A	Bioavailable			N/A	Bioavailable	N/A	N/A
Aquatic Life	Comparison of surface water data to protective screening concentrations <sup>3</sup>		Total PCBs							
	Comparison of porewater data to protective screening concentrations <sup>2</sup>							cis-1,2-DCE Vinyl chloride Total PCBs		
	Comparison of tissue residue data to critical body residues	Predatory fish	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs
		Bottom-feeding fish	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs	Total PCBs
		Predatory fish eggs								
		Bottom-feeding fish eggs								
Fish Condition Factor		NA	Good	Good	Good	Good	Good	Good	Good	

Notes:

1 For site-related contaminants (*i.e.* , PCBs and chlorinated solvents) only

2 Although porewater samples were only collected from EUs BB4, BB5, and BB6, exceedences occurred at EU BB5

3 Surface water data were evaluated system-wide

NA = not available

N/A = not applicable

Exposure Unit (EU) Abbreviations:

GB = Green Brook (RM -1.58 to 0)

BB1 = Bound Brook (RM 0 to 3.43)

BB2 = Bound Brook (RM 3.43 to 4.09)

BB3 = Bound Brook (RM 4.09 to 5.22)

BB4 = Bound Brook (RM 5.22 to RM 6.18)

BB5 = Bound Brook (RM 6.18 to 6.82)

BB6 = Bound Brook (RM 6.82 to RM 8.31)

SL = Spring Lake